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REQUIREMENTS ANALYSIS AND PROTOTYPE OF A DESKTOP  
FLIGHT SURGEON'S ASSISTANT

By

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DTIC QUALITY INSPECTION 4

DEDICATION

To My Wife Lee

And

My Two Beautiful Daughters

Cameron and Chandler

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FLIGHT SURGEON'S ASSISTANT

By

DOUGLAS M. ROUSE, BScE, BSEE, MSEE, MD

THESIS

Presented to the Faculty of The University of Texas-

Houston Health Science Center

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

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THE UNIVERSITY OF TEXAS-HOUSTON HEALTH SCIENCE CENTER  
SCHOOL OF PUBLIC HEALTH

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Thesis submitted to the M.P.H. Committee on June 30, 2000

# REQUIREMENTS ANALYSIS AND PROTOTYPE OF A DESKTOP FLIGHT SURGEON'S ASSISTANT

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U.S. Air Force flight surgeons are typically young, inexperienced physicians with limited training in areas where they assume the greatest responsibility. Even experienced flight surgeons find it difficult to keep up with the latest information. Some sources currently exist in the form of books, web sites, and software of various types, but most of these are limited in scope, incomplete, inefficiently organized, or in the case of the fixed media, rapidly outdated. The purpose of this effort was to create and assess the utility of a prototype desktop program to assist flight surgeons in rapidly accessing the specific information necessary to perform their duties in a proficient manner. A requirements analysis was performed by reviewing the literature most commonly used by flight surgeons as well as pertinent regulatory documentation. A limited capability prototype was constructed in a hierarchical web page fashion. The prototype was then evaluated by a group of flight surgeons with varying backgrounds and experience levels to obtain general impressions of the utility of such a system and guidance for future development.

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## INTRODUCTION

U.S. Air Force flight surgeons are typically young, inexperienced physicians with limited training in areas where they assume the greatest responsibility. These areas include public health, preventive medicine, occupational medicine, aerospace medicine, travel medicine, emergency medicine, readiness planning, and a range of administrative competencies unique to the Air Force, aerospace medicine community, and local organizations. When an experienced supervisor is present, he or she may be unavailable to adequately mentor and train the junior flight surgeon, or may lack the specific knowledge themselves. This results in an inefficient, trial and error, reinventing the wheel approach to getting the job done for many junior flight surgeons.

With the advent of the information age and the exponentially expanding volumes of rapidly changing, instantly accessible data on the Internet, even experienced flight surgeons find it difficult to keep up with the most current information. Some sources exist in the form of books, web sites, and computer software of various types, but most of these are limited in scope, incomplete, poorly organized, or, in the case of the fixed media, become rapidly outdated. Finding, organizing, and maintaining appropriate, current reference materials are tedious and unending tasks. For these reasons, it would be useful to have a desktop program to assist flight surgeons in rapidly accessing the specific information necessary for them to perform their duties in an efficient manner.

The goal of this effort was to construct a prototype system and have flight surgeons of varying experience levels evaluate it to obtain general impressions and guidance for

future development. In determining the structure and content of this desktop system, the primary questions addressed were:

- 1) What main categories of information would be most useful in assisting a flight surgeon to function proficiently?
- 2) What specific, detailed information in each of those main categories would be most useful?
- 3) What are the best sources for the above information?
- 4) What are the best methods to insure and maintain the currency of the above information?
- 5) What is the best way to package the above information to provide an efficient, useful tool for the busy flight surgeon?

The first two questions were addressed by reviewing the regulatory guidance, professionally recognized reference materials, and other references and tools specific to aerospace medicine and flight surgeon duties. The third question was addressed by attempting to use sources that are either regulatory in nature (OSHA, Air Force, and Department of Defense guidance and regulations) or provided by nationally or internationally recognized agencies or institutions (Centers for Disease Control, World Health Organization, etc.). With regard to maintaining currency, the use of information on the Internet is one way to aid with this task, but may not completely replace the need for vigilance in insuring the most current source of information is what is being accessed. In terms of packaging, a hierarchical web page style interface was chosen as an efficient structure to organize and access information, particularly with the intent to rely primarily on Internet sources.

## LITERATURE REVIEW

Several sources are available to determine the main categories of information as well as the more detailed information likely to be most valuable to a flight surgeon. The first of these is the three volume Flight Surgeon's Guide (O'Brien, 1998). This is the core text for the Aerospace Medicine Primary Course, which is the initial course Air Force physicians must complete to become a flight surgeon.

The first section of the Flight Surgeon's Guide is devoted to a brief discussion of the historical basis, mission, and organizational structure of the aerospace medicine program in the Air Force. Next, several areas of aerospace physiology are covered including high altitude respiratory physiology, decompression sickness, effects of acceleration and vibration, and thermal stress. A number of chapters on clinical aerospace medicine including unique aspects of otolaryngology, audiology, ophthalmology, psychiatry, psychology, internal medicine (and subspecialties), neurology, dentistry, and medication use are reviewed. A section covering health promotion, fitness, nutrition, sleep hygiene, and stress is also included. Following this are sections on aviation pathology and the medical aspects of aircraft mishap investigation, flight safety, emergency egress from aircraft, and global aeromedical evacuation.

Discussions are also provided on unique missions including search and rescue, assistance to civilian emergency medical services, manned space flight support to NASA, and special operations. Chapters on the military public health program, occupational medicine, deployment operations, missile medicine, space medicine, disaster preparedness

and nuclear, biological, and chemical (NBC) operations are also included. A review of sister service programs is provided in chapters on operational Army aviation medicine and Navy aerospace medicine. The text concludes with an aviation orientation section on physics and aerodynamics for flight surgeons.

A second valuable source is the Flight Surgeon's Checklist (Folarin, 2000). It also begins with a section on the aerospace medicine program structure and function. The second chapter is a compilation of useful references including phone numbers; a list of Air Force facilities; unique aviation codes/terminology; recommendations for flight surgeons checking in and flying at a new base; information on insignia, aircraft, organizational structure, aircrew training, and aerospace related continuing medical education (CME); recommended aerospace medicine related texts and journals; cross references for official Air Force publications; and a list of abbreviations and acronyms. The next chapter includes a section on clinical aerospace medicine and medications; a section on aircrew performance with subsections on alcohol, fatigue, circadian rhythm, nutrition, and airsickness; and a section on administrative actions including flying waivers and physical profiling. A chapter of medical references is also included with aids for electrocardiogram interpretation, pulmonary function test interpretation, ophthalmology tools, dermatomes, management of poisoning, burn depth diagnosis, and various formulas and aids to laboratory interpretation. The following chapter is a reference to contacts within the Federal Aviation Administration (FAA) and procedures for Aviation Medical Examiners (AME). (Air Force flight surgeons may become certified as AMEs and perform FAA physical examinations to medically qualify individuals for piloting civilian aircraft.) There are also chapters on deployment

preparation, aeromedical evacuation, mishap investigation, bioenvironmental engineering, public health, and physiology of the aerospace environment with similar content as the Flight Surgeon's Guide.

A relatively recent software publication titled The Ultimate Flight Surgeon Reference is a first attempt to construct a tool to accomplish what the author is referring to as a desktop FSA. It is a tri-service product published by the societies of U.S. Naval, U.S. Army, and U.S. Air Force flight surgeons. It's main interface includes icons leading to information specific to the U.S. Navy, U.S. Army, U.S. Air Force, Joint Chiefs of Staff, Federal Aviation Administration (FAA), National Aeronautics and Space Administration (NASA), Medical Evacuation (MEDEVAC), Preventive and Occupational Medicine, Operational Calculations, Tri-Service Waiver Guide, Acknowledgements, Table of Contents, User Tips, and "Plug-Ins". Since the system of interest in this effort is designed to support U.S. Air Force flight surgeons, the author will focus on examining the areas pertinent to that goal.

The second level interface for the U.S. Air Force icon includes a menu of icons with the following labels: Flight Surgeon's Guide; Deployment Preparation; Aeromedical Consult Service; Air Crew Briefings; Night Vision Goggles; Hyperbarics; Combat Edge; Life Science Reports; AFI 48-123 Medical Examination and Standards; and Aerospace Medicine Links. The Flight Surgeon's Guide icon just opens an electronic copy of this document. The Deployment Preparation icon opens a copy of an outline describing how to prepare and present a medical estimate of the situation briefing. The Aeromedical Consult Service (ACS) icon opens a document describing the process of preparing waivers and

obtaining appointments for ACS evaluation. The Aircrew Briefings icon opens a menu to “canned” briefings on aeromedical and safety topics. The Night Vision Goggles (NVG) icon opens a sublevel menu including an NVG training manual, NVG focusing chart, and printing program. The latter two menu items are nonfunctional.

The Hyperbarics icon opens the home page of the Davis Hyperbaric Laboratory website at Brooks AFB, Texas. The Combat Edge icon opens a lecture and draft policy documents on G-awareness training for aircrew. The Life Science Reports icon opens a page which instructs the user to install software containing a manual and template for creating life science reports (which are a component of mishap/accident reports). The AFI 48-123 Medical Examination and Standards icon opens that document, although it is an outdated version from 1994. The Aerospace Medicine Links icon opens a page containing 19 links to medical or aerospace medicine related websites.

Although a useful reference and good first effort, The Ultimate Flight Surgeon Reference could be more comprehensive and more efficiently organized. For example, areas such as travel medicine, medical evaluation boards, and medical evaluations for security clearances are not adequately covered. Also, much of the information is presented in large lists and not topically subdivided for easy reference.

Several websites exist which are specifically designed to support aerospace medicine. The first of these is the USAF School of Aerospace Medicine (USAFSAM) site (<http://wwwsam.brooks.af.mil/web/indexmain.htm>). The Aerospace Medicine subsection of this site has several links of interest to Flight Surgeons. These include links to a listing of Aerospace Medicine related courses, the Preventive Health Assessment program,



AFI 48-123 Medical Examination and Standards, AFPAM 48-133 Physical Examination Techniques, Air National Guard Aerospace Medicine, USAF Reserve Aerospace Medicine, the Resident's in Aerospace Medicine home page, a directory of worldwide web medical links, and a Tri-Service Aeromedical Dictionary. Although the items present on the USAFSAM website are useful, they are only a fraction of what would be needed to provide a comprehensive tool and are not organized in a functionally consistent manner. Several of the links are worth investigating further.

The Resident's in Aerospace Medicine (RAM) site (<http://wwwsam.brooks.af.mil/web/ram/Default.htm>) includes sub links to a listing of the military addresses of current and alumni RAMs, residency description and site overview, aerospace medicine residency program, USAFSAM education link, custom RAM coins, non-USAFSAM web links, RAM 2001, and a link to a previous version of the website. The links with the most potential practical value will be described in more detail.

The aerospace medicine residency program link contains sub-links to information for new applicants and separate handbooks for first, second, and third year residents (the third year handbook is listed as under construction). The USAFSAM education link contains sub links to aerospace medicine review topics and seminars; the Brooks Aeromedical Library (.mil access only); Combat Edge instructor's guide; deployment and global medicine; flight surgeon safety briefs; hyperbaric medicine; HQ Air Force Medical Operations Agency Air Force Association Symposium, 28 Apr 98; night vision goggles (NVGs) instructor's guide, briefings, charts, and training program; Operational Aeromedical Problems (OAP) conference highlights from 1998 and 1999; and the Society

of USAF Flight Surgeons Flightlines bibliography on “You Are the Flight Surgeon”. The non-USAFSAM web links link contains sub-links to the Alliance of Air National Guard Flight Surgeons Newsletter; the American Board of Preventive Medicine; Aviation Medicine Web Page Links; the CDC MMWR Update link; more aviation links; Occupational Medical Surveillance Manual DODI 6055.5-M, May 1998; and Virtual Flight Surgeon. Virtual Flight Surgeon is a civilian organization which assists individuals in obtaining FAA medical clearances.

The Air National Guard Aerospace Medicine site (<http://airguard.ang.af.mil/sg/aerospace/Aerospace/SGP.htm>) is one of the more extensive resources of information for flight surgeons. It has a menu of sub links labeled Physician’s Toolbox; Consolidated Memorandum; Forms and Reports; MEB Protocols; AFI 48-123; Aircrew Waiver Guide (Previous AFPAM 48-123); AMSUS Presentations; SME Protocols; Visit the State Air Surgeon (SAS) Home Page; AFPAM 48-133 (Aerospace Medicine Physical Examination Techniques); and USAF Commands/AFMS Directory.

The Physician’s Toolbox link contains sub-links labeled Aeromedical Summary Format; Aircrew Waiver Guide; Medical Board Format; Medical Board Protocols; ICE3; Top Knife; SME Protocols; Occupational Medicine; Line of Duty; Malcolm Grow Award; AFI 48-123; AF Form 422; DNIF Management; Fatigue Counter-Measures; Soft Contact Lens Program; Aircraft Mishaps; Suggestions; Orientation Flights; Aircrew Safety Briefings; Links (to) Major USAF Commands; and Herbal Medicine. Many of these sub-links are redundant with the links on the main menu.

The Aeromedical Summary (AMS) Format link contains a template for writing an AMS. (An AMS is a medical narrative used to request a waiver to keep someone on flying status.) The Aircrew Waiver Guide link connects to the Aeromedical Consult Service home page where a sub-link to the waiver guide exists. The waiver guide describes what information is required to be included in an AMS for a specific medical condition. The Medical Board Format link contains a template for writing a narrative summary for presentation to a Medical Evaluation Board (MEB). (A MEB is accomplished on military personnel when a medical condition is present which may disqualify them from the ability to perform worldwide duty.) The Medical Board Protocols link contains descriptions of how to properly prepare an MEB package, what information is required for specific conditions, and what the likelihood of waiver is.

The ICE3 link provides information and an application for flight surgeons who are interested in providing medical support to the Antarctic research station supply missions. The Top Knife icon is a nonfunctional link. (The Top Knife program is a 2-week course teaching flight surgeons the unique aspects of aviation medicine applied to high performance aircraft.) The SME Protocols link contains a 96-page document describing how a medical unit may properly prepare for deployment to a forward operating location. (SME stands for Squadron Medical Element. It consists of one or more physicians and technicians assigned to a squadron who deploy with and provide medical support for that squadron.)

The Occupational Medicine link contains a 22-page guide to conducting occupational medicine surveillance exams for aerospace medicine personnel. This also

contained a valuable sub-link to Health Services Inspection (HSI) requirements. The Line of Duty link would not open. The Malcolm Grow Award link contains a biography of Malcolm Grow and a description of the award and nomination process for flight surgeons. The AFI 48-123 link contains this previously described document. The AF Form 422 link was nonfunctional. (The AF Form 422 is a serial profile. It is used to communicate the mental and physical capabilities and limitations of an individual to non-medical personnel.) The DNIF Management link was non-functional. (DNIF stands for "Duties Not to Include Flying" and means that an aviator is grounded.) It is likely this link was intended to provide instruction on the proper procedures for the grounding and returning to flying status (RTFS) of personnel on flying status.

The Fatigue Counter Measures, Soft Contact Lens Program, Aircraft Mishaps, Suggestions, Aircrew Safety Briefings, and Herbal Medicine links were all non-functional. The Orientation Flights link contained Air Force Instruction 11-401, Air National Guard Supplement 1, Flight Management, with a subsection describing medical evaluation for orientation flights. The Links (to) Major USAF Commands link contained links to the organization home pages as listed.

The next link on the ANG aerospace medicine home page was Consolidated Memorandum. This contains various medical administrative guidance, most of which is redundant with previously described links. The only other link of interest which is not redundant with those already covered is the State Air Surgeons Home Page. This page also includes mostly redundant or impertinent links. One link of interest is to the Alliance of Air National Guard Flight Surgeons home page. This page included a menu with a sub link

titled "Topics of Interest" with links to the following items of interest: an aerospace virtual library, U.S. State Department, CDC Medical Travel Information, Central Intelligence Agency, Center of Excellence in Disaster Management and Humanitarian Assistance (a site under construction).

A less comprehensive site was that of the Air Force Reserve Command Surgeon's Office (<http://w3.afrc.af.mil/hq/sg/default.htm>). There were not any links of aerospace medicine significance which have not already been reviewed.

Other sources of information include Air Force regulations and policy guidelines. The majority of these are found in the 48 series on Aerospace Medicine. Summary guidance defining the purpose and functions of the Aerospace Medical Program (AMP) is contained in Air Force Policy Directive 48-1 (AFPD 48-1, 1993). The purpose is to "sustain and improve the health and performance of personnel assigned to operations functions, to prevent disease and injury in the work force, and to protect the environment". Specific functions include "medical care for all flyers and other specified personnel"; a "focus on identifying and reducing risks of illness or injury"; ensuring the "occupational health of its people by identifying work-site health hazards, recommending control measures, assessing fitness for work, conducting medical surveillance, educating workers, and providing clinical services"; and "monitoring emissions to the environment as well as the environment's overall quality". The three primary metrics for assessing compliance with this directive are "lost duty days due to occupational illness and injury"; "environmental and occupational health violations"; and "operations related class A mishap

rates with possible significant human factors contributions". This document provides the context in which the efforts of flight surgeons should be directed to support.

The translation of AFPD 48-1 into operational requirements is outlined in Air Force Instruction 48-101 on Aerospace Medical Operations (AFI 48-101). Areas of responsibility are assigned to offices within the Air Force and specific program elements are outlined. The program elements are aircrew health, disease prevention, occupational health program, and environmental quality. The accomplishment of the specific tasks and objectives within these program elements require a cooperative effort between Flight Medicine (FM), Bioenvironmental Engineering (BES), Public Health (PH), Aerospace Physiology, Health Promotion, and Medical Readiness, collectively known as Team Aerospace.

The premier civilian reference on aerospace medicine is DeHart's Fundamentals of Aerospace Medicine (1996). It represents an important subset of information of which flight surgeons are expected to be knowledgeable. The first section reviews the historical, modern, and future perspectives of aerospace medicine. The second section reviews the physiology of the flight environment, including topics on respiration, pressure, acceleration, vibration, noise, communication, spatial orientation, thermal stress, and the unique aspects of the space environment. The third section covers the clinical practice of aerospace medicine. Major topics in this section are health care maintenance, cardiovascular and pulmonary medicine, ophthalmology, otolaryngology, neuropsychiatry, miscellaneous medical and surgical conditions of aeromedical concern, and passenger/patient considerations. The fourth section is on operational aerospace medicine. It includes discussions of the unique aspects of U.S. Air Force, U.S. Army, U.S. Navy, Federal

Aviation Administration, civilian, and international aviation /aerospace medicine. It also covers accident prevention, survival, rescue, and investigation; human factors; management of human resources in air transport; and the biomedical challenges of space flight. The fifth and last section of the text reviews the impact of the aerospace industry on community health. There are discussions on the role of aviation in the transmission of disease, occupational and environmental medicine, and aviation's effect on the environment.

Prior to DeHart's text, the premier texts on aviation medicine and later aerospace medicine were those of Major General Harry Armstrong, a pioneer in aviation medicine and the second Surgeon General of the U.S. Air Force (Armstrong 1952, 1961). The topical coverage is very similar to DeHart's text, and it appears DeHart may have used Armstrong's work as a model.

The above is a review of the categorical and specific subject areas for which flight surgeons are required to be knowledgeable. In sum, they represent the topical requirements necessary for construction of a comprehensive and useful tool to assist flight surgeons. With regard to the question of what are the best sources of information, there are three important factors: accuracy, currency, and relevance.

As designer of the prototype system, the author determined what information was relevant based on experience, the above references, and feedback from fellow flight surgeons. The most practical method for obtaining the most current information is through the Internet. This is not to say that information found on the Internet is always the most current, but use of the Internet is the most efficient way to obtain current information if it is

available. If required information is not available through the Internet, it could be obtained and loaded into the system manually, but would require periodic review and update.

The question of accuracy from a practical standpoint depends to a large extent on the authority and reputation of the source. From an authority standpoint, Air Force and other published U.S. government guidance directs the actions of Air Force flight surgeons except in cases when that direction would cause unintended harm. From a reputation standpoint, respected state, national, and international organizations, associations, and agencies are probably more consistently likely to have accurate information than unknown sources. Examples include the Centers for Disease Control, American Heart Association, American Red Cross, World Health Organization, etc. This is not to say that inaccurate information cannot be presented by respected organizations, and anytime an individual is using new information with potentially significant consequences, it is important to cross-reference and verify the validity of the information if possible. For the most part, the author attempted to use sources which fell in the above categories.

With regard to packaging the information to provide the most efficient and useful tool, the author relied on his own experience and preferences, and the feedback he received from fellow flight surgeons to guide development. The existing tools and sources described above all suffer from one of several deficiencies. First, they are not comprehensive in providing the breadth and depth of practical information necessary for accomplishing the day-to-day duties of a flight surgeon. Second, they often include extraneous information which is not of practical value. Third, they often represent a jumble of documents and links without an efficient, logical, hierarchical thread connecting them. Fourth, they often



contain unnecessary redundancy. Fifth, they are constructed around references to whole documents or other bulk information, as opposed to specific problem solution information. They provide links to places where an answer may be found as opposed to providing links directly to the answer.

An example of how this might be improved is as follows. Assume one wanted to obtain information to design a medical surveillance program for asbestos workers. With most of the current sources reviewed, the user may be provided a link to Occupational Medicine topics. Within this category, there may be a link to the Department of Defense (DOD) guidance document and a link to the Occupational Safety and Health Administration (OSHA) home page. The user might select the DOD guidance and then have to search through the document to find information on asbestos. The user would then go back up a level and link to the OSHA home page, try to find the pertinent OSHA documents, search through them for asbestos, and then search through the asbestos section to locate medical surveillance.

What the author proposes is a hierarchical thread that would quickly lead to the specific, appropriate sources of guidance needed. This would differ from an ordinary search engine in that search engines often generate large numbers of sources, many of which are not pertinent. Also, the order in which the results are listed may be based on how much an advertiser paid rather than the degree of match to the search query. The method of this effort is analogous to a search engine that would pre-sort and list only the most pertinent and useful resources to answer specific questions.

In the above example, the user would select a top-level link to Occupational Medicine and then select a sublevel link to medical surveillance. The medical surveillance link would contain a list of regulated materials along with other information. The user would select asbestos and this would provide a sub-list of all the pertinent regulatory and other documents providing guidance on medical surveillance for asbestos. Upon selecting one of these documents, the system would link to the page within the document that specifically addresses medical surveillance for asbestos. Since the user is provided with a list of the pertinent regulatory guidance for asbestos, it decreases the probability of missing something (for example, asbestos is covered under both 29 CFR 1910 and 1926). Also, the user is taken directly to the substance specific medical surveillance page, avoiding the time-consuming search within a larger document or web site.

Thus, the goal is to design an efficient, logically structured desktop tool to access information necessary to perform the duties of a flight surgeon in a proficient manner.

## METHODS

The goal of this effort was to develop a prototype tool to assist Flight Surgeons in performing their duties in a more efficient and effective manner. The first step was to derive and organize the required information into a top-level interface and hierarchical sub-levels. The next step was to develop the software to transform this information into a web page style tool. Upon receiving approval from The Committee for the Protection of Human Subjects (Appendix A), this tool was evaluated by a group of eight USAF Flight Surgeons recruited from the Master of Public Health program in San Antonio, Texas. The objective and subjective results of this evaluation were then analyzed.

### PROTOTYPE DESIGN

Using the categorical and specific information described above, my own experience and preferences, and informal feedback received from other Flight Surgeons, a top level interface for a Flight Surgeon's Assistant (FSA) was derived (See Figure 1). Next, a set of

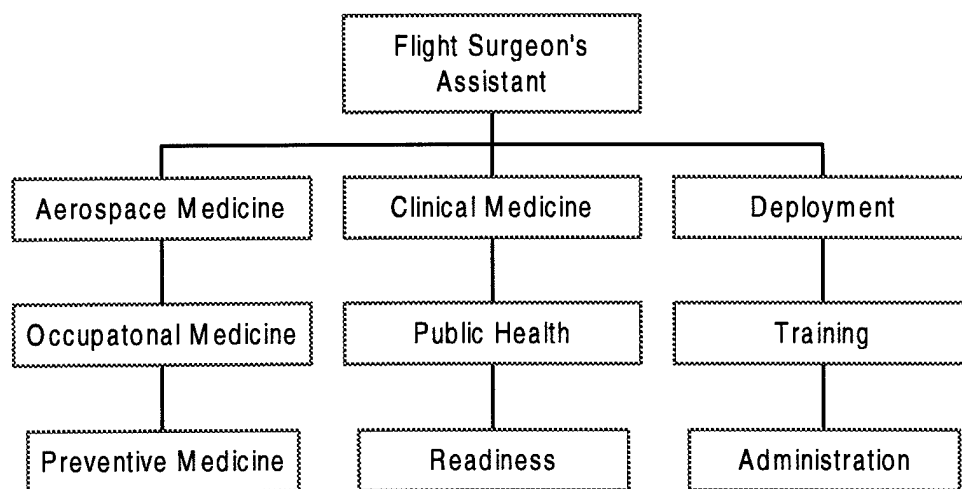


FIGURE 1: TOP LEVEL INTERFACE DESIGN

16 questions was developed representing a broad range of tasks or problems that a typical flight surgeon may encounter (Appendix B). In many cases, these questions were based on real scenarios from the author's and other flight surgeons' experiences. Using these questions as a breadth-oriented catalyst, a subset of specific information and links was selected to fill in the second level and, in some cases, third level pages in the tool. Some subtopics were cross-referenced under two or more higher-level categories, representing the overlap that occurs between certain topical areas.

Once the concept demonstration design requirements were completed, the software prototype was developed using Microsoft FrontPage 2000 ®. This is a WYSIWYG (what you see is what you get) Hypertext Markup Language (HTML) editor, which is a relatively easy to use tool for creating and maintaining hierarchical web designs. The resulting product is shown in Appendix C.

### HUMAN SUBJECTS

Upon completion of the prototype, a group of eight USAF flight surgeons of varying backgrounds and experience were used to evaluate it. They were all recruited from the Master of Public Health program in San Antonio, Texas, and were all residents in the Air Force Aerospace Medicine residency program. A letter of recruitment was forwarded to each of them describing the project and requesting their assistance in evaluating it (Appendix D). The letter instructed them to contact the author by phone, email, or in writing if they wished to participate. All of the candidate participants responded and all of them agreed to participate and subsequently did. Each of them signed an informed consent prior to participating (Appendix E). In addition to being in equal student status, the

majority of the participants militarily outranked the author, and therefore the author had no coercive authority or influence over the participants. The participants all appeared interested in contributing to the development of a tool which may make it easier to perform their jobs.

### STUDY DESIGN

The primary purpose of the evaluation of the prototype Flight Surgeon's Assistant was to derive subjective information on the usefulness and desirability of having such a tool and to obtain feedback on how to improve the structure and content. Objective data were collected only as supportive information for the subjective conclusions and to provide an artificially stimulating environment for more efficient and rigorous interaction during evaluation sessions. The number of uncontrolled variables and sources of bias in this type of evaluation casts doubt on the statistical validity of the objective data obtained, and this was accepted in light of the primary goals as described above.

Individuals who elected to participate in the study were randomly divided into two groups of four each. Each group of flight surgeons was then provided the same series of 16 questions to complete within a limited amount of time (Appendix B). These questions included a range of both common and uncommon problems that a flight surgeon may be confronted with. One group used a combination of a desktop computer with Internet access and common reference books to answer the first eight questions, and the same desktop computer with the FSA alone to answer the second eight questions. The other group performed a similar procedure but used the FSA alone to answer the first eight questions and used Internet access and common reference books to answer the second eight questions.

The specific evaluation procedure began with first arranging a time and location with the participant to complete the evaluation. Three of the trials were completed in the Aerospace Medicine residents' room at the US Air Force School of Aerospace Medicine (USAFSAM) and the other five were accomplished in the library at the School of Public Health (due to resource conflicts at USAFSAM). Prior to beginning an evaluation, each participant was given an opportunity to review the Informed Consent and ask any questions. After the Informed Consent was signed, an explanatory pre-briefing was given including procedures and instructions for completing the evaluation (Appendix F).

Upon completion of the pre-briefing, each participant was allowed to review the resources they would have available to answer the 16 questions. Two minutes were provided to review the available reference books (See Table 1). One minute was provided to familiarize themselves with the Internet browser (Microsoft Internet Explorer®) and a folder in the "Favorites" menu titled Flight Surgeon's Assistant with links to commonly used reference sites (See Table 2). Finally, two minutes were provided for participants to review and familiarize themselves with the Flight Surgeon's Assistant tool (Appendix C). Once the orientation to resources was complete, the timed evaluation began.

TABLE 1: REFERENCE BOOKS AVAILABLE DURING FSA EVALUATION

Air Force Instruction 48-123, Medical Examinations and Standards, 1 January 2000.
DeHart, RL. Fundamentals of aerospace medicine. 2 <sup>nd</sup> ed. Baltimore, MD: Williams & Wilkins; 1996.
Folarin, VA. Flight Surgeon's Checklist. 6 <sup>th</sup> ed. Brooks AFB, TX: Society of USAF Flight Surgeons; May 2000.
Medical management of chemical casualties handbook. 3 <sup>rd</sup> ed. Aberdeen Proving Ground-Edgewood Area (APG-EA), MD: USAMRICD; Dec. 1998.
O'Brien, DM. Flight Surgeons Guide, Vol. I. 5 <sup>th</sup> ed. Brooks AFB, TX: USAFSAM; 1998.
O'Brien, DM. Flight Surgeons Guide, Vol. II. 5 <sup>th</sup> ed. Brooks AFB, TX: USAFSAM; 1998.
O'Brien, DM. Flight Surgeons Guide, Vol. III. 5 <sup>th</sup> ed. Brooks AFB, TX: USAFSAM; 1998.

TABLE 2: "FAVORITES" AVAILABLE DURING FSA EVALUATION

Air Force Instruction 48-115, The Tuberculosis Detection and Control Program, 29 June 1994. ( <a href="http://afpubs.hq.af.mil/pubfiles/af/48/afi48-115/afi48-115.pdf">http://afpubs.hq.af.mil/pubfiles/af/48/afi48-115/afi48-115.pdf</a> )
Air Force Instruction 48-123, Medical Examinations and Standards, 1 January 2000. ( <a href="http://afpubs.hq.af.mil/pubfiles/af/48/afi48-123/afi48-123.pdf">http://afpubs.hq.af.mil/pubfiles/af/48/afi48-123/afi48-123.pdf</a> )
Department of Defense Instruction 6055.5-M, Occupational Medical Surveillance Manual, May 1998. ( <a href="http://www.denix.osd.mil/denix/Public/ES-Programs/Safety/Documents/6055.5/manual.html">http://www.denix.osd.mil/denix/Public/ES-Programs/Safety/Documents/6055.5/manual.html</a> )
Department of Defense Instruction 6055.12, DoD Hearing Conservation Program, April 22, 1996. ( <a href="http://www.denix.osd.mil/denix/Public/ES-Programs/Force/Safety/6055-12.html">http://www.denix.osd.mil/denix/Public/ES-Programs/Force/Safety/6055-12.html</a> )
Centers for Disease Control and Prevention STD Prevention Home Page ( <a href="http://www.cdc.gov/nchstp/std/stdp.html">http://www.cdc.gov/nchstp/std/stdp.html</a> )
Medical management of biological casualties handbook. 3 <sup>rd</sup> ed. U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick, MD, July 1998 ( <a href="http://ccc.apgea.army.mil/Documents/HandbookonBioCas/Handbook.htm">http://ccc.apgea.army.mil/Documents/HandbookonBioCas/Handbook.htm</a> )
Medical management of chemical casualties handbook. 3 <sup>rd</sup> ed. Aberdeen Proving Ground-Edgewood Area (APG-EA), MD: USAMRICD; Aug. 1999. ( <a href="http://ccc.apgea.army.mil/Documents/Red%20Handbook/001TitlePage.htm">http://ccc.apgea.army.mil/Documents/Red%20Handbook/001TitlePage.htm</a> )
Medical management of radiological casualties handbook, 1 <sup>st</sup> ed., Military Medical Operations Office, Armed Forces Radiobiology Research Institute, Bethesda, MD, December 1999. ( <a href="http://www.afri.usuhs.mil/www/outreach/pdf/radiologicalhandbooksp99-2.pdf">http://www.afri.usuhs.mil/www/outreach/pdf/radiologicalhandbooksp99-2.pdf</a> )
National Center for Health Statistics Home Page. ( <a href="http://www.cdc.gov/nchs/default.htm">http://www.cdc.gov/nchs/default.htm</a> )
Occupational Safety and Health Administration (OSHA) Regulations and Compliance Links Page. ( <a href="http://www.osha.gov/comp-links.html">http://www.osha.gov/comp-links.html</a> )
Waiver Guide, USAF School of Aerospace Medicine, Clinical Sciences Division, Brooks AFB, TX. ( <a href="http://quicksand.brooks.af.mil/web/af/afc/table.htm">http://quicksand.brooks.af.mil/web/af/afc/table.htm</a> )

Each participant was randomly assigned to complete the first eight questions with either the reference books and Internet access or the Flight Surgeon's Assistant, and then switched resources for the second eight questions. All timing was done with a digital stopwatch and times were measured to the nearest second, and then transposed to fractional minutes to the nearest hundredth of a minute for simplification of calculations. When the individual indicated he was ready, 15 seconds was allowed for him to read the question and 5 minutes was allowed for him to locate a correct answer. Most of the questions had

“correct” answers that were indisputable (e.g. finding a quote in a regulation). In many cases though, there were multiple references containing the same correct answer. In a few cases, there was no single correct answer, but potentially many correct answers. For example, one question asked that a reference be found which described toxicity and first aid for hydrazine exposure. Any reference or combination of references that described both toxicity and first aid for hydrazine exposure was an “acceptable” answer. Thus, an “acceptable” answer for any question simply met all the conditions imposed by the question.

When the individual located an answer they would call “time”. Timing would then be stopped and the answer was reviewed. If it was an acceptable answer, the time was recorded along with an abbreviated answer and the reference. If it was not an acceptable answer, the participant would be informed that it was inadequate and why, and timing would continue. When the first eight questions were completed, the available resources would be switched, and the same procedure repeated for the second eight questions. When all 16 questions were complete, the participants were asked to complete the feedback portion of the survey.

### DATA CONTROL

No personal identifiers were placed on any of the questionnaires. None of the questions asked specifically elicited any information which may be used to infer who the participant was from the responses provided. The identity of participants was not provided to other participants. The only documents with any identifying information are the Informed Consent documents.



## ANALYSIS

The results were reviewed to see if any trends existed in the amount of time necessary to answer each question and in the number of times participants failed to obtain an acceptable answer with and without the aid of the FSA. Specifically, the amount of time necessary to complete each question with and without the aid of the FSA was compared, including the mean, median, and standard deviation. A comparison of the overall per-question response time with and without the FSA was also accomplished, including the mean, median, and standard deviation.

The Wilcoxon Signed Rank Test was also accomplished comparing median response times with and without the FSA for each of the 16 questions. This nonparametric statistic was chosen because it can be used to compare the differences in values for pairs of observations from populations that are not independent. A parametric statistic was not used since the response times had an artificial upper bound of 5-minutes, thus the uncertainty in predicting variance would make any conclusion difficult to defend.

The overall number of times questions were unanswered within the five-minute time limit was compared between the trials using and not using the FSA. A tally of the number of questions where the mean and median response times were faster using the FSA compared to not using the FSA was also compared. The number of questions with a mean response time less than 1 minute was compared as well.

The primary goals of this exercise were twofold. First, to provide a subjective impression of whether a tool of this sort would be useful and provide more efficient access to information. Second, by having the participants interact with the system in a structured,

timed exercise, it stimulated more robust impressions than if they were just asked to sit down and experiment with the system and provide feedback. The methods used were successful in achieving these goals.

## RESULTS

The response times for each subject are shown in Appendix G. Two response times were discarded from the data, and in both cases the cause was an Internet link that would not respond within the 5-minute time limit. The mean and median response times for answering each question using the Flight Surgeon's Assistant (FSA) were faster than the times obtained without using the FSA in 11 of 16 and 13 of 16 questions respectively (See Tables 3 & 4). The mean response time for question 7 was the same with and without use of the FSA. The mean and median response time comparisons are graphically depicted in Figures 2 and 3. The FSA was noted to have a response time advantage of greater than two minutes on questions 3, 4, 5, 14 and 15.

The overall mean and median response time for all questions answered without the FSA were 3.5 and 3.9 minutes respectively (See Table 5). The overall mean and median response time for all questions answered with the FSA were 2.3 and 1.9 minutes respectively (See Table 5). This yields a mean response time advantage of 1.2 minutes and a median response time advantage of 2.0 minutes when using the FSA.

TABLE 3: MISCELLANEOUS STATISTICS COMPARING RESPONSES AND RESPONSE TIMES WITH AND WITHOUT USE OF THE FLIGHT SURGEON'S ASSISTANT (FSA)

CATEGORY	- FSA	+ FSA
NUMBER OF QUESTIONS WITH A <b><u>FASTER MEAN</u></b> RESPONSE TIME	4	11
NUMBER OF QUESTIONS WITH A <b><u>FASTER MEDIAN</u></b> RESPONSE TIME	3	13
NUMBER OF TIMES QUESTIONS WERE <b><u>UNANSWERED</u></b> IN THE 5 MINUTE TIME LIMIT	26	5
NUMBER OF QUESTIONS WITH A <b><u>MEAN RESPONSE TIME LESS THAN 1 MINUTE</u></b>	7	16

TABLE 4: SUMMARY RESPONSE TIME DATA

Question	Summary Response Time Statistics (fractional minutes)					
	Mean		Median		Standard Deviation	
	-FSA	+FSA	-FSA	+FSA	-FSA	+FSA
1	4.6	3.8	4.8	3.8	0.6	1.0
2	3.9	4.0	4.9	4.6	1.9	1.5
3	5.0	1.2	5.0	1.3	0.0	0.7
4	4.1	0.7	5.0	0.6	1.6	0.5
5	3.4	1.1	4.0	1.2	1.8	0.5
6	0.3	0.5	0.1	0.5	0.5	0.3
7	3.8	3.8	4.0	3.7	1.3	1.0
8	4.7	3.6	5.0	3.8	0.6	1.1
9	3.6	3.5	3.6	3.3	1.7	0.9
10	2.4	1.8	1.8	1.0	1.9	2.2
11	2.2	2.5	1.7	1.9	1.9	1.6
12	3.1	3.3	3.0	3.4	1.5	1.9
13	2.0	1.6	2.1	1.5	1.2	0.6
14	5.0	1.5	5.0	1.6	0.0	0.7
15	4.3	1.4	4.5	1.4	0.8	1.0
16	3.0	1.5	2.9	1.5	1.5	0.5

Note: (-FSA) indicates response time data obtained without using the FSA.  
 (+FSA) indicates response time data obtained while using the FSA.

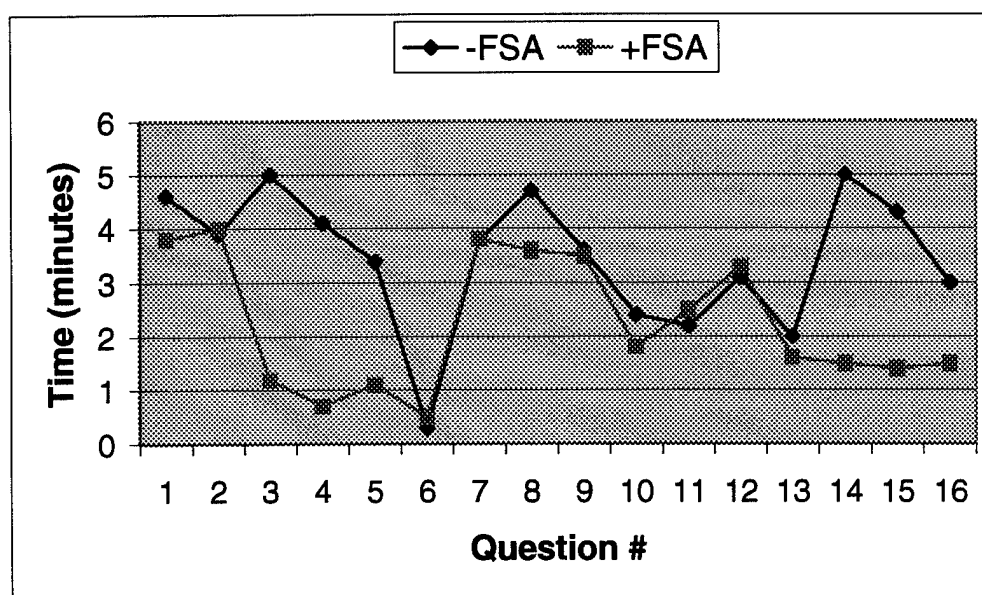
FIGURE 2: COMPARISON OF MEAN RESPONSE TIME WITH AND WITHOUT THE FLIGHT SURGEON'S ASSISTANT (FSA)

FIGURE 3: COMPARISON OF MEDIAN RESPONSE TIME WITH AND WITHOUT THE FLIGHT SURGEON'S ASSISTANT (FSA)

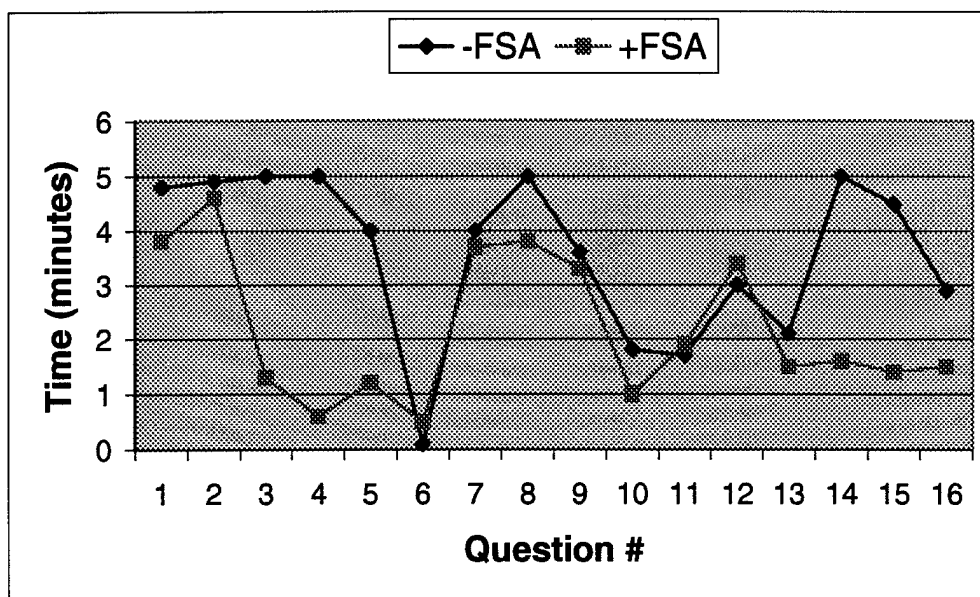


TABLE 5: SUMMARY RESPONSE TIME STATISTICS FOR QUESTIONS ANSWERED WITHOUT (-FSA) AND WITH (+FSA) THE FLIGHT SURGEON'S ASSISTANT

Per-Question Response Time (Minutes)	-FSA	+FSA
Mean	3.5	2.3
Median	3.9	1.9
Standard Deviation	1.7	1.6

There were 26 instances when subjects were unable to answer questions without the FSA within the 5 minute time limit versus only 5 instances when the FSA was being used (See Table 3). This partially explains the skewness of the data obtained. The arbitrary time limit of 5 minutes also kept the mean and median response times for both trial methods lower than they otherwise would have been. With a 26 to 5 ratio of instances of unanswered questions, it is likely the mean and median response times for the questions

answered without the FSA would have increased significantly more than the response times for the questions answered with the FSA. This could only have been accomplished by allowing each subject an unlimited amount of time to answer each question, which would have been impractical and would have removed the time pressure incentive to locate an answer as quickly as possible.

The mean response times and variances for the population of all USAF Flight Surgeons is unknown, the response time data have an artificial upper bound of 5 minutes, and the two samples are from populations that are not independent. Thus, the nonparametric Wilcoxon Signed-Rank Test was performed on the results for the 16 questions comparing the differences between the median response times using versus not using the FSA. The null hypothesis was that there is no difference between the median response time obtained using versus not using the FSA in answering the 16 trial questions ( $H_0: \text{median}_{\text{-FSA}} = \text{median}_{\text{+FSA}}$ ). The alternative hypothesis was that there is a difference between the median response time obtained using versus not using the FSA in answering the 16 trial questions ( $H_A: \text{median}_{\text{-FSA}} \neq \text{median}_{\text{+FSA}}$ ). A two-sided test was selected since the possibility existed that response times could have been slower or faster using the FSA. The result was that using the FSA yielded a faster median response time with  $p = 0.004$  and a 94.8% confidence interval for the difference in median response times of 0.4 to 2.2.

Seven of the questions answered without the aid of the FSA had mean response times of less than one minute versus 16 questions with the aid of the FSA (See Table 3). All of the respondents felt that a fully developed tool would be useful (See Table 6). Six of the eight respondents provided suggestions for additions or improvements (See Table 7).

TABLE 6: RESPONSES TO EXIT QUESTION "A"

A. Do you feel a fully developed tool similar to the prototype FSA would be useful for Flight Surgeons?		
YES	NO	
# of "YES" responses: 8	# of "NO" responses: 0	# Unanswered: 0
Specific Comments:		
1) "Essential to efficiency"		
2) No comment written		
3) "Good idea to bring all of this together"		
4) No comment written		
5) "Very user friendly. Has helpful links @ your fingertips."		
6) "This is a codified version of many of our own bookmarks-very useful!"		
7) "It was much easier to use when all the information and links were consolidated in one place."		
8) "Having all resources combined into one tool would be very useful"		

TABLE 7: RESPONSES TO EXIT QUESTION "B"

B. Do you have any suggestions for improvement, either in structure or in content?		
YES	NO	
# of "YES" responses: 5	# of "NO" responses: 2	# Unanswered: 1
Specific Comments:		
1) "Not just make it available but teach its use"		
2) "Search engine within site" and "Make (all) links hot"		
3) "Headed in the right direction"		
4) "add 4 Fox handbook" and "add American Academy of FP web site"		
5) No comment written		
6) "Give a master reference for dead links"		
7) "Try to make it useful as a stand alone product in cases where there is no internet connectivity capability."		
8) "A interactive tutorial for the first time user"		

## DISCUSSION

The participants in the evaluation of the prototype Flight Surgeon's Assistant (FSA) were unanimous in their endorsement of the concept of a desktop tool to assist flight surgeons in accessing useful information in a more efficient manner. For the most part, they approved of the basic design layout and top-level interface and had a number of useful suggestions for further improvement in the underlying content. These included adding specific links, incorporating a local search engine, and providing a tutorial for novice users.

The response time data were surprisingly indicative of a time advantage in the use of the FSA versus the reference books and Internet access. In the initial design, the FSA was to be compared against unaided Internet access alone. This approach seemed too biased in favor of the FSA, and thus the decision was made to include common reference texts and a folder of Internet "Favorites" links to common reference material to make the comparison more fair. The author formulated all of the questions used in developing and testing the FSA with input from other Flight Surgeons. This also introduced significant bias into the comparison, but as mentioned above, effort was made reduce this by providing similar resources to subjects when not using the FSA.

In the final design, only two questions (3 & 14) did not have acceptable answers available in either the reference texts or in the "Favorites". Thus, these were the only two questions that required participants to search the worldwide web to find answers. Including these two questions without a rapidly accessible reference when not using the FSA was intentional to demonstrate the utility and convenience of having ready access to some possibly less often accessed information. A simple search using the keywords



“hypertension” and “diet” for question number 3 and “hydrazine” for question number 14 locates an acceptable answer without much difficulty. However, not a single participant located acceptable answers to questions 3 and 14 within the 5-minute time limit without the aid of the FSA, whereas all of the participants using the FSA were able to locate answers within 5 minutes.

Question numbers 4, 5, and 15 showed a distinct response time advantage when using the FSA. For question number 4, there was an easily accessible direct link to the appropriate reference in the “Favorites”. However, most of the subjects chose to search futilely in AFI 48-123 first. For question number 5, the cause of the response time difference was not readily apparent. It was anticipated the response times would be faster for those subjects who answered the question without the FSA since a printed copy of the reference was available in addition to an online version. For question number 15, the “Favorites” contained a link to the National Center for Health Statistics (NCHS) Home Page (See Table 2) and the FSA contained a link to specific page with the correct answer within the NCHS site. This provided a time advantage to the FSA on this question because subjects not using the FSA had to locate and select the appropriate link on the NCHS site to find the reference with the correct answer.

Only four mean and three median response times were faster when not using the FSA. For question 2, the mean and median response times were so close that no difference likely exists. Question 6 is the second of a two-part question. The difference in mean and median response times is not large, but is likely due to having a printed reference available and open when not using the FSA. Those using the FSA often closed the document, and

then had to reopen it and search for the same section again. For question 11, the difference again is small. It is likely attributable to a combination of individual variability and the need to move to the appropriate second level in the FSA and locate the appropriate document versus selecting the document directly off the "Favorites" when not using the FSA. The same rationale also applies to the difference noted in question 13.

There were a number of sources of bias in this evaluation, many of which were not controllable. The experience and knowledge level of the participants with regard to both computer and Internet use as well as knowledge of the question subject matter is one factor. It was obvious that some participants were more comfortable and efficient using Internet browser tools. It was also obvious when participants were familiar with the subject matter in the questions and knew exactly where to look in a particular reference for the answer.

Another source of bias was the level of energy and enthusiasm displayed by participants. Some participants moved swiftly in attempting to locate an answer to a question, while others proceeded more cautiously. Another source of bias was in the use of the Internet itself. From day to day and minute to minute, the speed with which a particular web site may be accessed varies, and in some cases a server may not respond at all. Two individual response times had to be discarded due to the server not responding for the link selected within the 5-minute time limit. To a certain extent, some of these biases should be self-canceling, in that the bias was present for the questions answered by the same person both with and without the FSA.

Overall, the potential utility of a fully developed hierarchical tool like the prototype FSA was demonstrated. The design and evaluation process stimulated ideas for a number

of improvements to incorporate into a final product. First, enhancing and further developing an “answer oriented” hierarchical thread in the structure of the system would be useful. This idea was discussed at the end of the literature review, but not fully implemented due to programming constraints and limitations in the way some of the sites were structured.

Second, it would be useful to have pop-up text boxes that would give hints and more detailed descriptions of various links. An example of how this might work is that when either the mouse pointer is placed over a link or when a link is selected, a text box would appear. This text box would give hints on finding the most commonly used information from that site and a description of what the main categories of information in that site are.

One document in the Centers for Disease Control and Prevention STD Prevention site that would have been a desirable link was the STD Treatment Guidelines. The problem was that the address for these guidelines included their date. Thus, when new guidelines were created and placed on the site, it is likely the date would change, thus creating a “dead” or obsolete link. To get around this, I linked to the parent site, and the user then had to find the treatment guidelines link from a long list of items running down the left hand side of the page. Once that page was open, they had to click again on the title of the document to open it. This design choice helped make the tool more robust and easier to maintain, but made it more difficult for the user to access the needed piece of information. One way to avoid this tradeoff is for web site developers to use generic or at least non-dated names in the addresses of their documents, so when they update the document the name may remain the same. Otherwise, something like the pop-up text box described above

could be used to instruct the user how to find the document once they open the parent site.

A third effort will involve filling in the depth of the structure with useful links. Once the initial structure and topical areas are filled in adequately, this will become a never-ending process of adding and updating links as new sources and new information become available. This is another reason that linking to higher levels within sites will make the system more reliable and maintainable, but less user friendly (although clicking on a "dead" link is not very user friendly either).

A fourth idea to implement is having a switch for each page or link within a page to select between an archive version of a link or an online version. As mentioned previously, sometimes an Internet connection may be slow or a server may not respond at all. When a Flight Surgeon is deployed, Internet access may not be available. For this reason, an archive copy of most or all of the information contained in each of the links would be very useful to have. The disadvantage of this is that it would require a lot of memory. It is likely that to implement this feature would take multiple CD-ROMs or DVD formatted disks. Practically, this would be a feature implemented in a stepwise fashion with the most critical and commonly used items implemented first, and additional items implemented as reasonably priced higher capacity storage media become available.

A fifth improvement would be to incorporate the capability to allow individual users to tailor the interface and include links to sites that they discover to be useful. This would allow users to not only have the capabilities of the generic FSA at their disposal, but allow them to enhance and mold the tool to be responsive to their unique mission requirements.

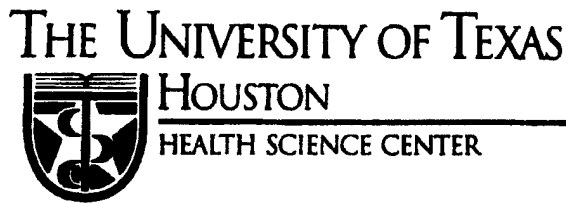
A final improvement would be to add the capability to have links to stand-alone

CD-ROM programs. At least one useful reference could not be accessed in the development of the FSA because it is only available on CD-ROM. By adding the above feature, if you clicked on a link to a CD-ROM document, the system would prompt you to insert the appropriate CD-ROM and then open the corresponding program. This feature would also allow the use of a CD-ROM archive edition of the FSA as described above.

Developing a prototype Flight Surgeon's Assistant was a worthwhile endeavor, and the resulting product has the potential to become a valuable and useful tool. Having links to the most appropriate and commonly used resources consolidated in a tailored interface provides an efficient and effective means of accessing information. Further development is indicated to create a system adequate to be released for field-testing and use.

## APPENDICES

APPENDIX A: CPHS APPROVAL LETTER



The Committee for the  
Protection of Human Subjects

**NOTICE OF APPROVAL TO BEGIN RESEARCH**

May 19, 2000

**HSC-SPH-00-034** - "Requirements, Analysis, and Prototype of a Desktop Flight Surgeon's Assistant"

PI: Douglas M. Rouse, MD, MPH Student; Chair - Dr. Bradshaw

**PROVISIONS:** Unless otherwise noted, this approval relates to the research to be conducted under the above referenced title and/or to any associated materials considered at this meeting, e.g. study documents, informed consents, etc.

**APPROVED:** At a Convened Meeting

**APPROVAL DATE:** April 21, 2000

**EXPIRATION DATE:** March 31, 2001

**CHAIRPERSON:** Anne Dougherty, MD

Subject to any provisions noted above, you may now begin this research.

**CHANGES** - The P.I. must receive approval from the CPHS before initiating any changes, including those required by the sponsor, which would affect human subjects, e.g. changes in methods or procedures, numbers or kinds of human subjects, or revisions to the informed consent document or procedures. The addition of co-investigators must also receive approval from the CPHS. ALL PROTOCOL REVISIONS MUST BE SUBMITTED TO THE SPONSOR OF THE RESEARCH.

**INFORMED CONSENT** - Informed consent must be obtained by the P.I. or designee using the format and procedures approved by the CPHS. The P.I. must instruct the designee in the methods approved by the CPHS for the consent process. The individual obtaining informed consent must also sign the consent document.

**UNANTICIPATED RISK OR HARM, OR ADVERSE DRUG REACTIONS** - The P.I. will immediately inform the CPHS of any unanticipated problems involving risks to subjects or others, of any serious harm to subjects, and of any adverse drug reactions.

**RECORDS** - The P.I. will maintain adequate records, including signed consent documents if required, in a manner which ensures confidentiality.

## APPENDIX B: EVALUATION SURVEY

### Evaluation Survey for a Prototype Desktop Flight Surgeon's Assistant (FSA)

I appreciate your time and effort in volunteering to evaluate a prototype of a Desktop FSA. Please answer the following questions using information that you locate through access to the Internet and reference texts or using the FSA as instructed. For each question, please write a brief reference describing the source used in locating the answer (i.e. AFI 48-123, web address, etc.). Do not answer questions based on your own knowledge or experience. The purpose of this exercise is to assess the relative ease with which you could locate the answer to a question given that you don't already know or remember the answer. You may use any search engine you choose in using the Internet. Do not spend more than 5 minutes completing any question. If you are unable to complete a question within 5 minutes, go to the next question.

QUESTIONS 1-8, USE:                      Internet/Reference texts only                      FSA only

- A. You are preparing the medical surveillance documents for asbestos abatement workers. The bioenvironmental data indicate medical surveillance is indicated based on the OSHA construction standards. In reviewing the medical surveillance requirements, you wish to verify the following:

1A. According to the OSHA construction standards, what organ systems are to be emphasized on history and physical exam?

Answer:

Reference:

Completion Time: \_\_\_\_\_ minutes

Comment:

2A. The OSHA standard mandates examination of the GI system (digestive tract). According to DOD guidance, what are the recommended physical examination elements of the gastrointestinal system?

Answer:

Reference:

Completion Time: \_\_\_\_\_ minutes

Comment:

- B. You are evaluating an aviator for a waiver for hypertension. He meets criteria for attempting diet and exercise control.

3B. What dietary regimen would you recommend? (i.e. Locate a handout you could give him describing the regimen.)

Answer:

Reference:

Completion Time: \_\_\_\_\_ minutes

Comment:



4B. He was unsuccessful in a 6-month trial of diet and exercise control and you decide to place him on an anti-hypertensive medication. Assuming adequate blood pressure control is achieved, what basic laboratory studies are required to include in the initial waiver request?

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

- C. A flying class II aviator was playing crud at the club and was struck in the head with a ball. He was knocked unconscious for a period of about 2 minutes, but upon regaining consciousness had amnesia of the evening's events for about 4 hours. He subsequently recovered fully and had a normal exam.

5C. What category head injury is this? (Assuming a radiographically normal cranium with no subsequent sequelae)

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

6C. What study must be done within two calendar days of the event to expedite a waiver for this aviator's return to flying status?

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

- D. An aviator returned from deployment a month ago and recently noted a genital lesion. RPR and MHA-TP are both reactive and the aviator admits to high-risk behavior.

7D. What is the appropriate first line antibiotic treatment (including dosage) based on current CDC guidelines (assuming the patient has no known drug allergies)?

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

- E. A non-rated security forces troop is deploying to Kenya for two months and has presented to obtain malaria prophylaxis.

8E. What regimen would you prescribe (including dose, but disregard terminal prophylaxis though)?

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

**COMPLETION TIME FOR QUESTIONS 1-8:** \_\_\_\_\_ **minutes**

**QUESTIONS 9-16, USE:**

**Internet/Reference texts only**

**FSA only**

- F. A 38 yo aviator presents with a 16mm induration following PPD placement. He is asymptomatic with a normal chest radiograph. He reports a recent deployment to a country with endemic tuberculosis, but otherwise has no risk factors. He has had 2 consecutive negative PPDs (0mm) in the past 2 years.

9F. Should prophylactic treatment with INH be started (assuming he is not an immediately needed critical flying asset)?

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

10F. If so, how long must the aviator be grounded without any adverse reaction before returning to flying status?

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

- G. A terrorist attack occurred with some form of chemical agent. You arrive on the scene in your chemical defense gear, you note a casualty on the ground seizing. Another member of the response team exposed M8 paper to nearby droplets of liquid and it turned a "gold" yellow color.

11G. What class of chemical agent was most likely used?

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

12G. You have Mark I kits available. Assuming the casualty was exposed to the above agent, how many MARK Is in addition to what other drug are recommended to be given immediately to this patient? (While you're simultaneously removing them to a decontamination area!)

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

- H. Pending approval of AFOSH 48-20, hearing conservation program guidance is DODI 6055.12.

13H. Under the new guidelines, what constitutes a significant threshold shift (STS)?

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

- I. You were recently assigned to an F-16 squadron. You have been tasked to give a briefing on hydrazine toxicity and first aid to first responders.

14I. Find reference material to accomplish this.

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

- J. You want to better prepare for patient counseling during Preventive Health Assessment examinations.

15J. Locate statistics on leading causes of death by age, sex, and race to help you tailor your preventive counseling.

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

- K. You have been tasked to brief at the wing Instrument Refresher Course. The topic is G-excess effect/illusion.

16K. Find information to use in constructing a briefing on this topic.

**Answer:**

**Reference:**

**Completion Time:** \_\_\_\_\_ minutes

**Comment:**

**COMPLETION TIME FOR QUESTIONS 9-16:** \_\_\_\_\_ **minutes**

**TOTAL COMPLETION TIME FOR ALL QUESTIONS:** \_\_\_\_\_ **minutes**

This concludes the timed portion of the survey. Please answer questions A and B below relating to your subjective impressions of the FSA.

A. Do you feel a fully developed tool similar to the prototype FSA would be useful for Flight Surgeons?                      YES                      NO

Comments:

B. Do you have any suggestions for improvement, either in structure or in content?

YES                      NO

Comments:

## APPENDIX C: FSA WEB PAGES AND INSTRUCTIONS

The following pages contain screen capture figures of the FSA 1<sup>st</sup> and 2<sup>nd</sup> level web pages. Instructions on how to use the FSA are given below:

1. Insert the CD-ROM with the FSA program.
2. Double-click on “My Computer” and then double click on the CD-ROM drive.
3. Double-click on “index.htm”. This opens the top level or home page of the FSA as shown in Figure 2.
4. Alternatively, you may copy the fsa-web directory from the CD-ROM to your computer, open the folder, and double-click on “index.htm”.
5. Click on any icon to go to the corresponding main category page.
6. Within main category pages, click on any link to go to that particular subject matter or sub-level page.
7. From any of the main category or sub-level pages, you may click on the wings at the top of the page to return to the home page.
8. When finished surfing, just close the browser to exit the program.

FIGURE 2: TOP LEVEL/HOME PAGE OF FSA

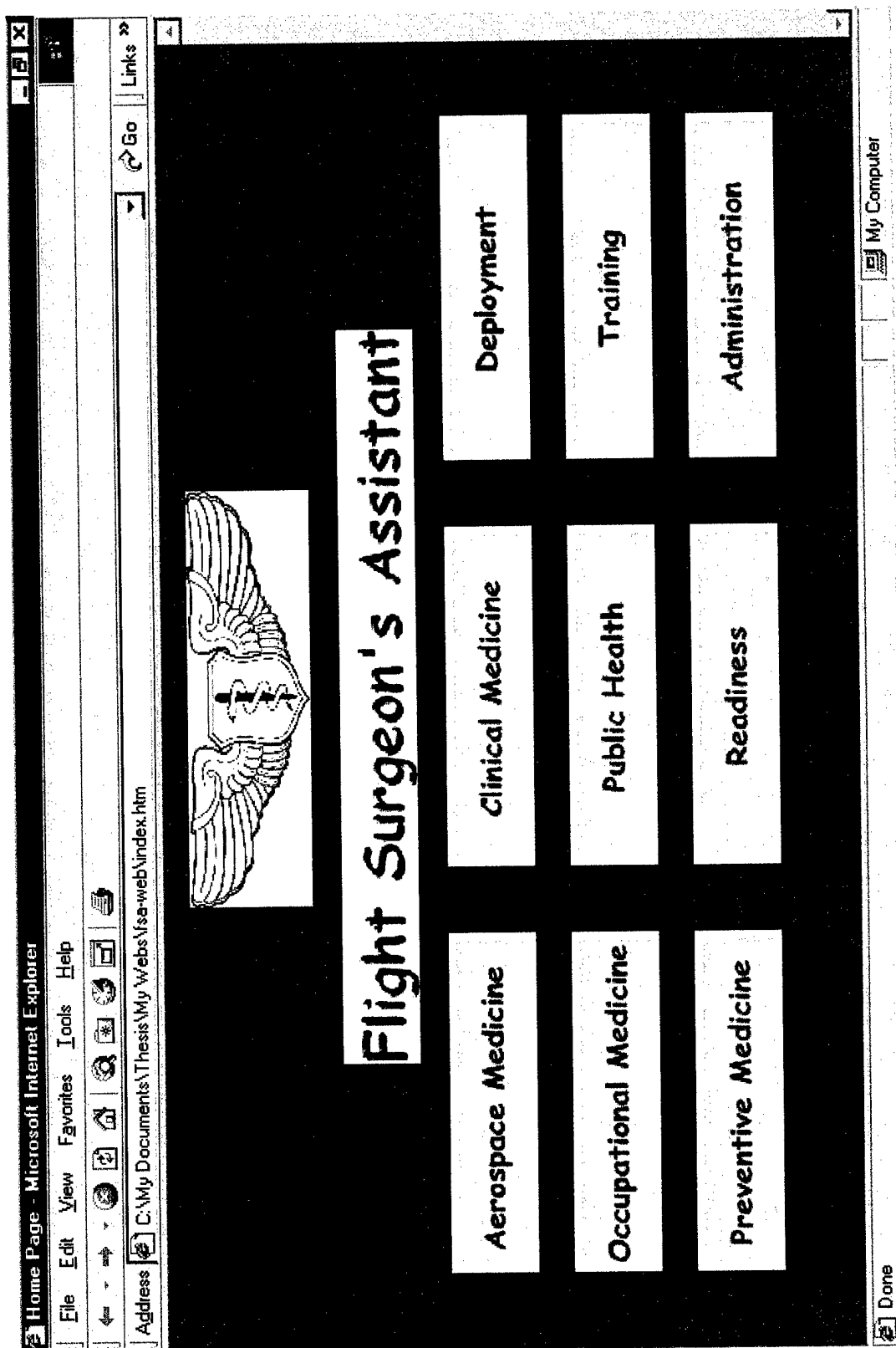
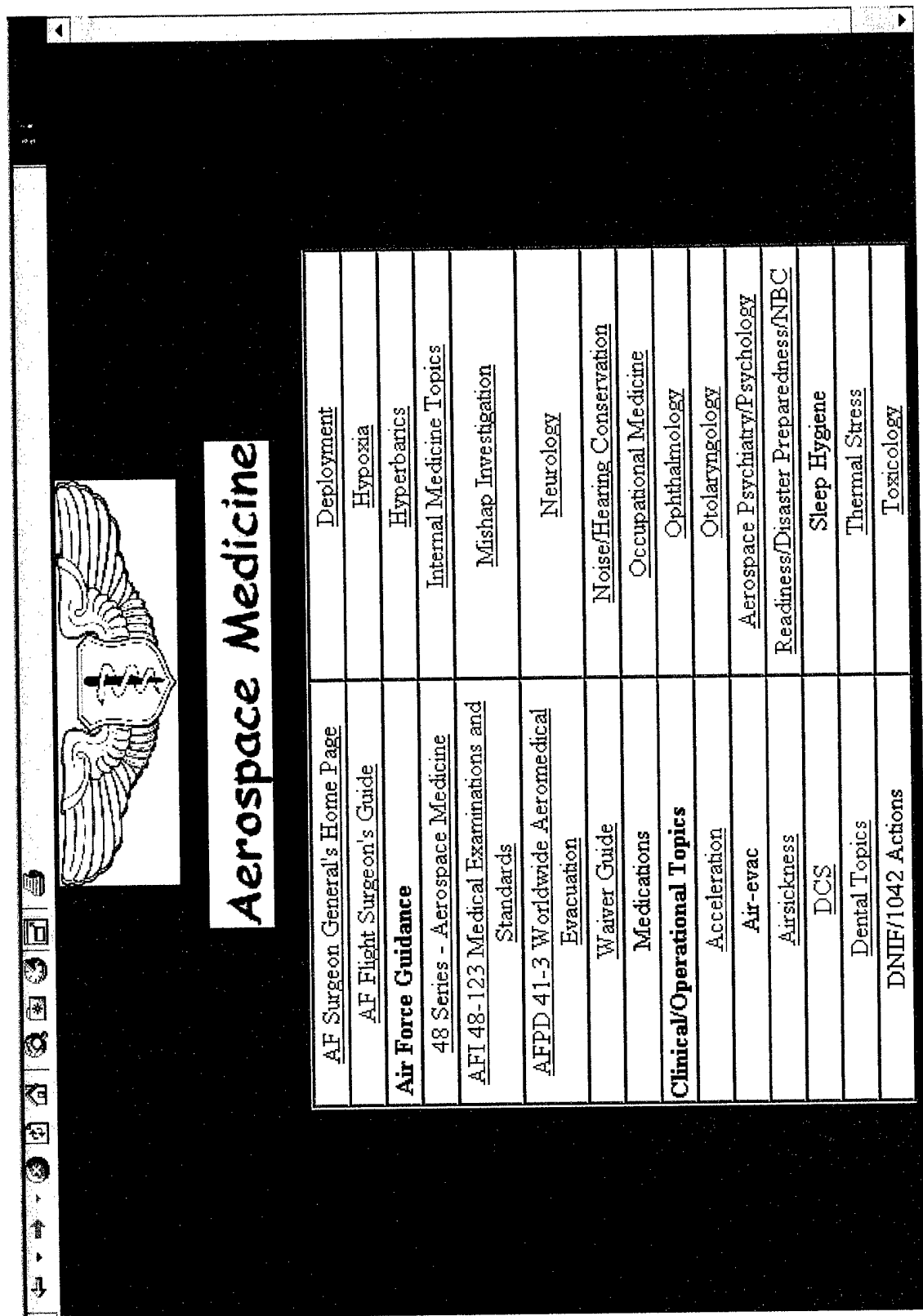


FIGURE 3: AEROSPACE MEDICINE PAGE



<a href="#">AF Surgeon General's Home Page</a>	<a href="#">Deployment</a>
<a href="#">AF Flight Surgeon's Guide</a>	<a href="#">Hypoxia</a>
<b>Air Force Guidance</b>	<a href="#">Hyperbarics</a>
<a href="#">48 Series - Aerospace Medicine</a>	<a href="#">Internal Medicine Topics</a>
<a href="#">AFI 48-123 Medical Examinations and Standards</a>	<a href="#">Mishap Investigation</a>
<a href="#">AFPD 41-3 Worldwide Aeromedical Evacuation</a>	<a href="#">Neurology</a>
<a href="#">Waiver Guide</a>	<a href="#">Noise/Hearing Conservation</a>
<a href="#">Medications</a>	<a href="#">Occupational Medicine</a>
<b>Clinical/Operational Topics</b>	<a href="#">Ophthalmology</a>
<a href="#">Acceleration</a>	<a href="#">Otolaryngology</a>
<a href="#">Air-evac</a>	<a href="#">Aerospace Psychiatry/Psychology</a>
<a href="#">Airsickness</a>	<a href="#">Readiness/Disaster Preparedness/NBC</a>
<a href="#">DCS</a>	<a href="#">Sleep Hygiene</a>
<a href="#">Dental Topics</a>	<a href="#">Thermal Stress</a>
<a href="#">DNIF/1042 Actions</a>	<a href="#">Toxicology</a>

FIGURE 4: OCCUPATIONAL MEDICINE PAGE

Federal and DOD Guidance	Injuries
<a href="#">OSHA Index</a>	<a href="#">Medical Surveillance</a>
<a href="#">CFR 1910 Occupational Safety and Health Standards</a>	<a href="#">ADA (Americans w Disabilities Act)</a>
<a href="#">CFR 1926 Safety and Health Regulations for Construction</a>	<a href="#">Hearing Conservation</a>
<a href="#">DOD 6055.5-M Occupational Medical Surveillance Manual</a>	<a href="#">Worker's Compensation</a>
<a href="#">NIOSH Home Page</a>	<b>TOXIC SUBSTANCE INFO</b>
<a href="#">AFOSH 48-8 Controlling Exposures to Hazardous Materials</a>	<a href="#">ATSDR</a>
<a href="#">Air Force Occupational Health Page</a>	<a href="#">Asbestos</a>
<b>CLINICAL TOPICS</b>	<a href="#">Cadmium</a>
<a href="#">Ergonomics</a>	<a href="#">Hydrazine</a>
<a href="#">Fitness for Duty/Disability Evaluations</a>	<a href="#">JP-8</a>
<a href="#">Illnesses</a>	<a href="#">Lead</a>

FIGURE 5: PREVENTIVE MEDICINE PAGE


 <h1>Preventive Medicine</h1>	
Prevention in Clinical Medicine	Health Services
<u>AF Office for Prevention and Health Services Assessment</u>	<u>Social/Behavioral Topics</u>
<u>Preventive Health Assessment (PHA)</u>	<u>Environmental Health</u>
<b>Diet Recommendations For:</b>	<u>Occupational Health</u>
<u>Hypertension</u>	<u>Epidemiology</u>
<u>Cholesterol</u>	<u>Health Statistics</u>
<u>Weight Loss</u>	<u>Resources</u>
<b>Exercise Recommendations For:</b>	<u>Associations</u>
<u>Stretching</u>	<u>ACPM, ATPM, ABPM</u>
<u>Strengthening</u>	<u>Publications</u>
<u>Pregnancy</u>	<u>AJPM</u>
<u>Aerobic Conditioning</u>	
<u>Low Impact Aerobic Conditioning</u>	<u>Board Review Topics</u>



FIGURE 6: CLINICAL MEDICINE PAGE

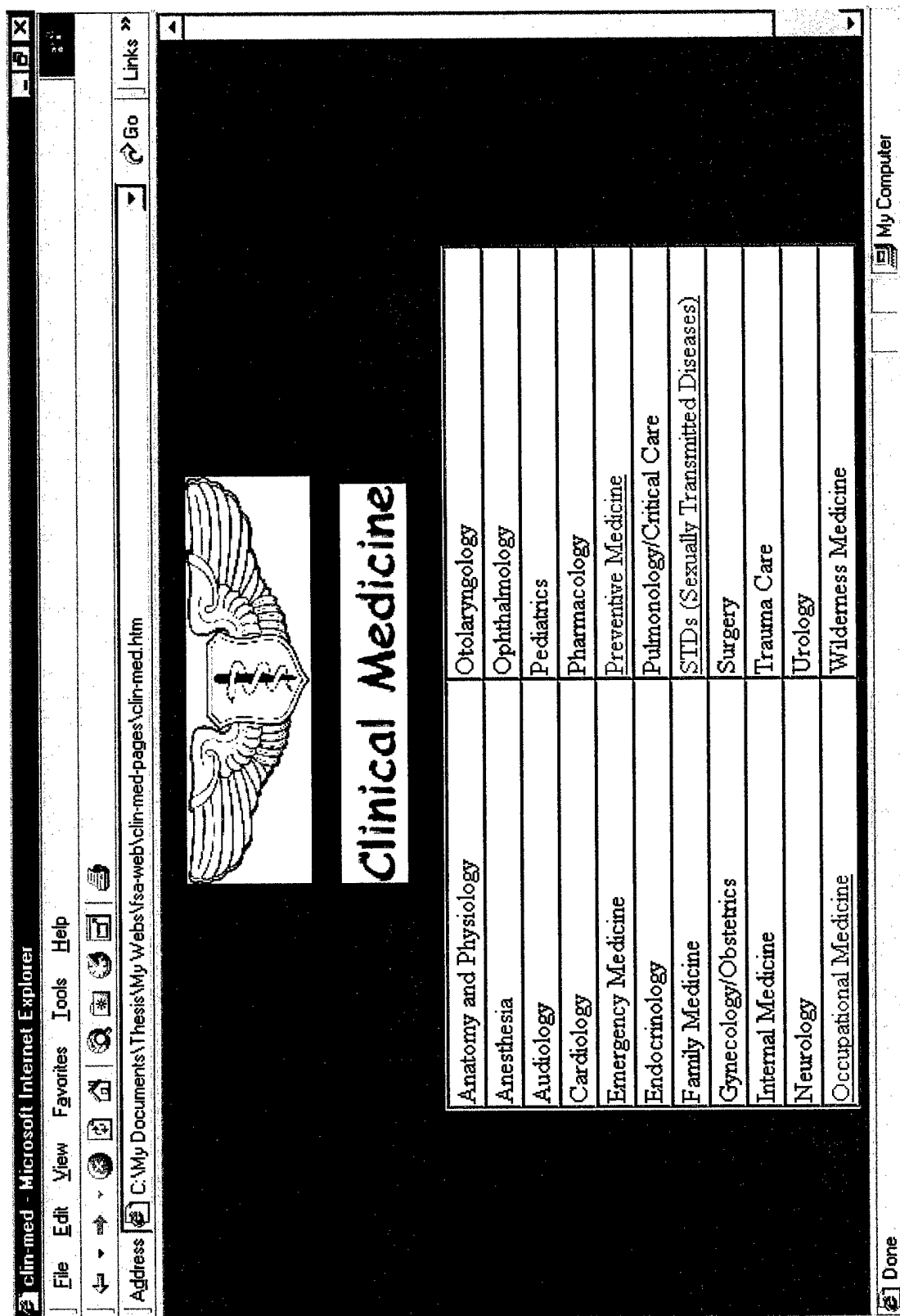


FIGURE 7: PUBLIC HEALTH PAGE

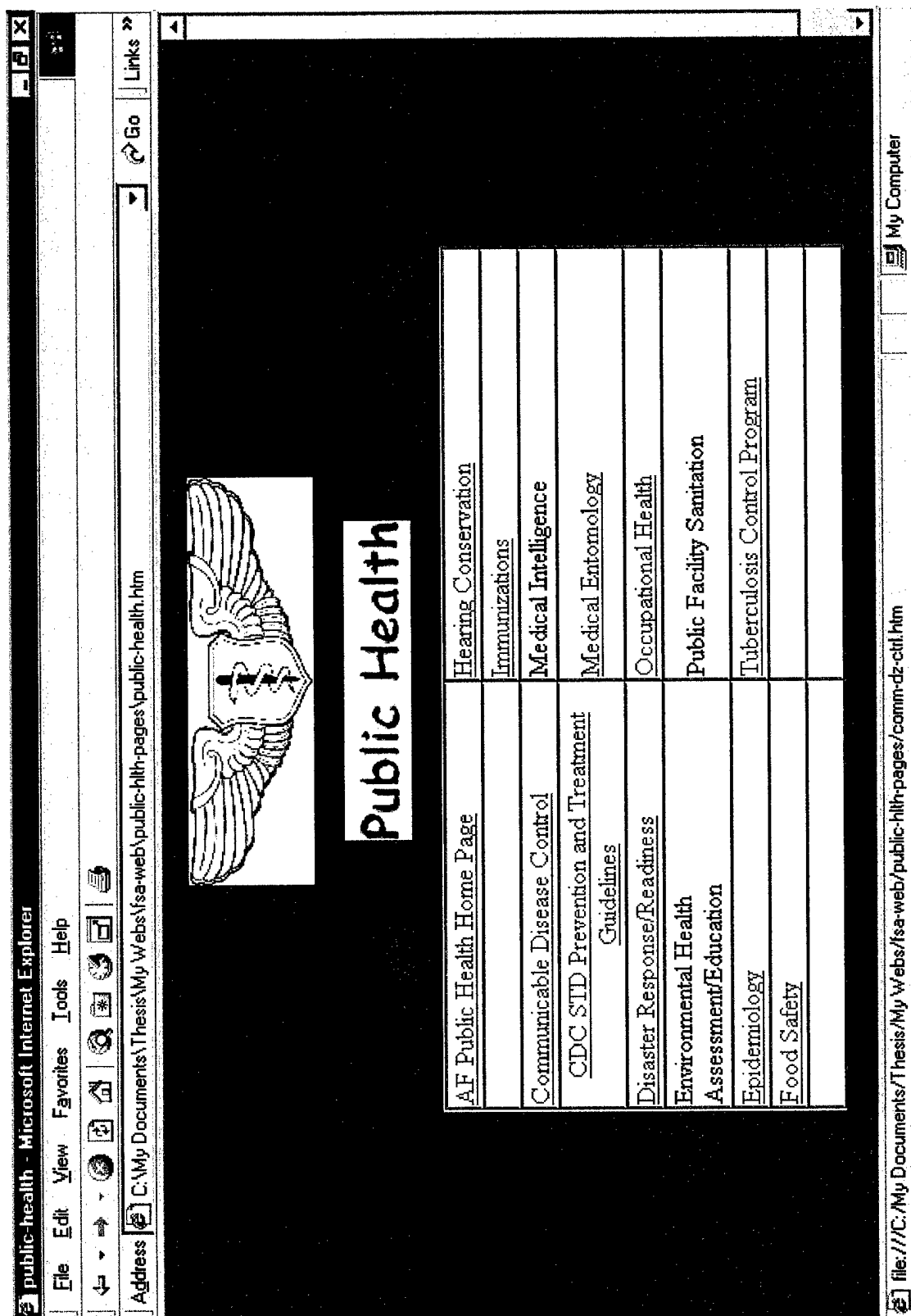


FIGURE 9: DEPLOYMENT PAGE

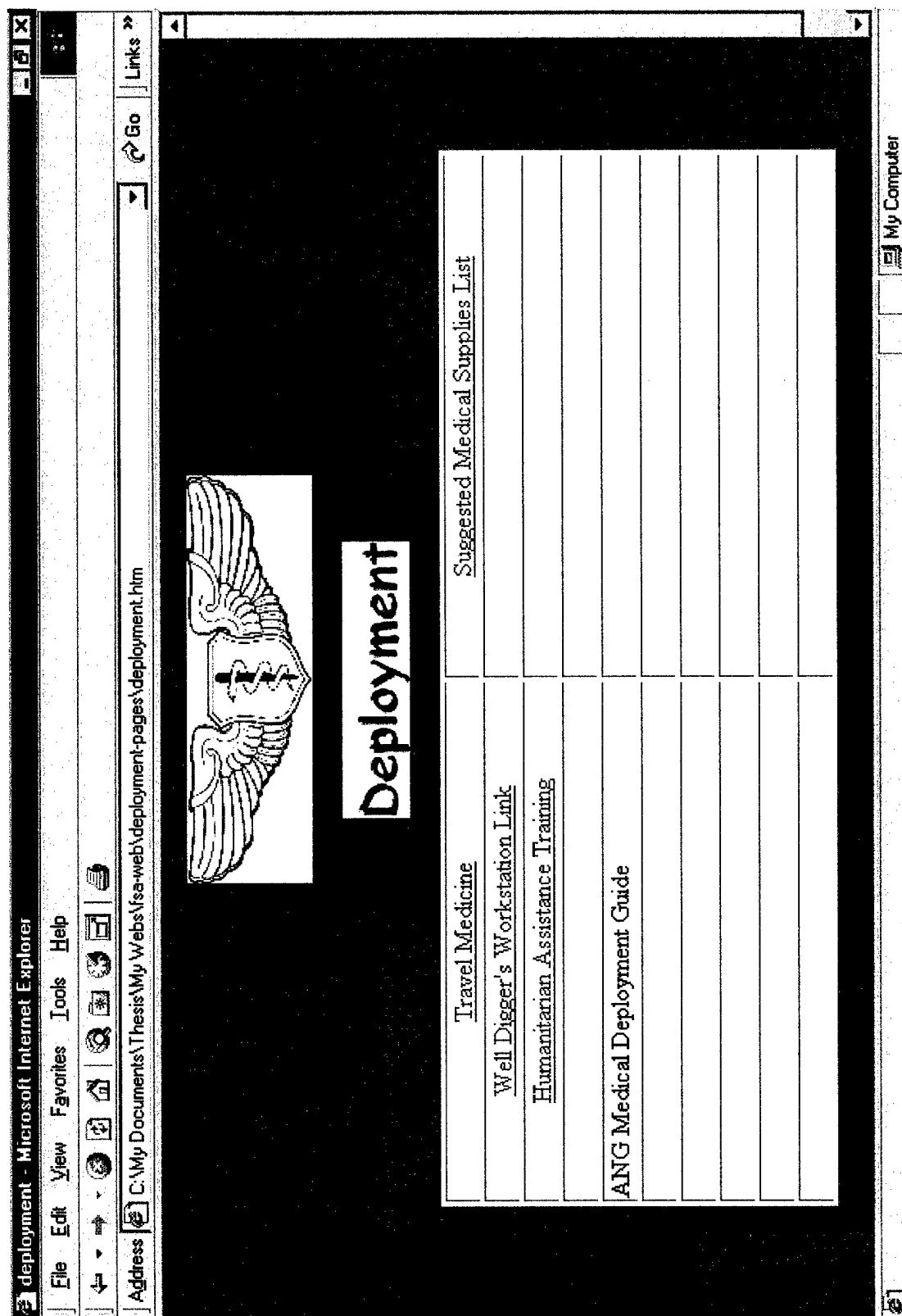
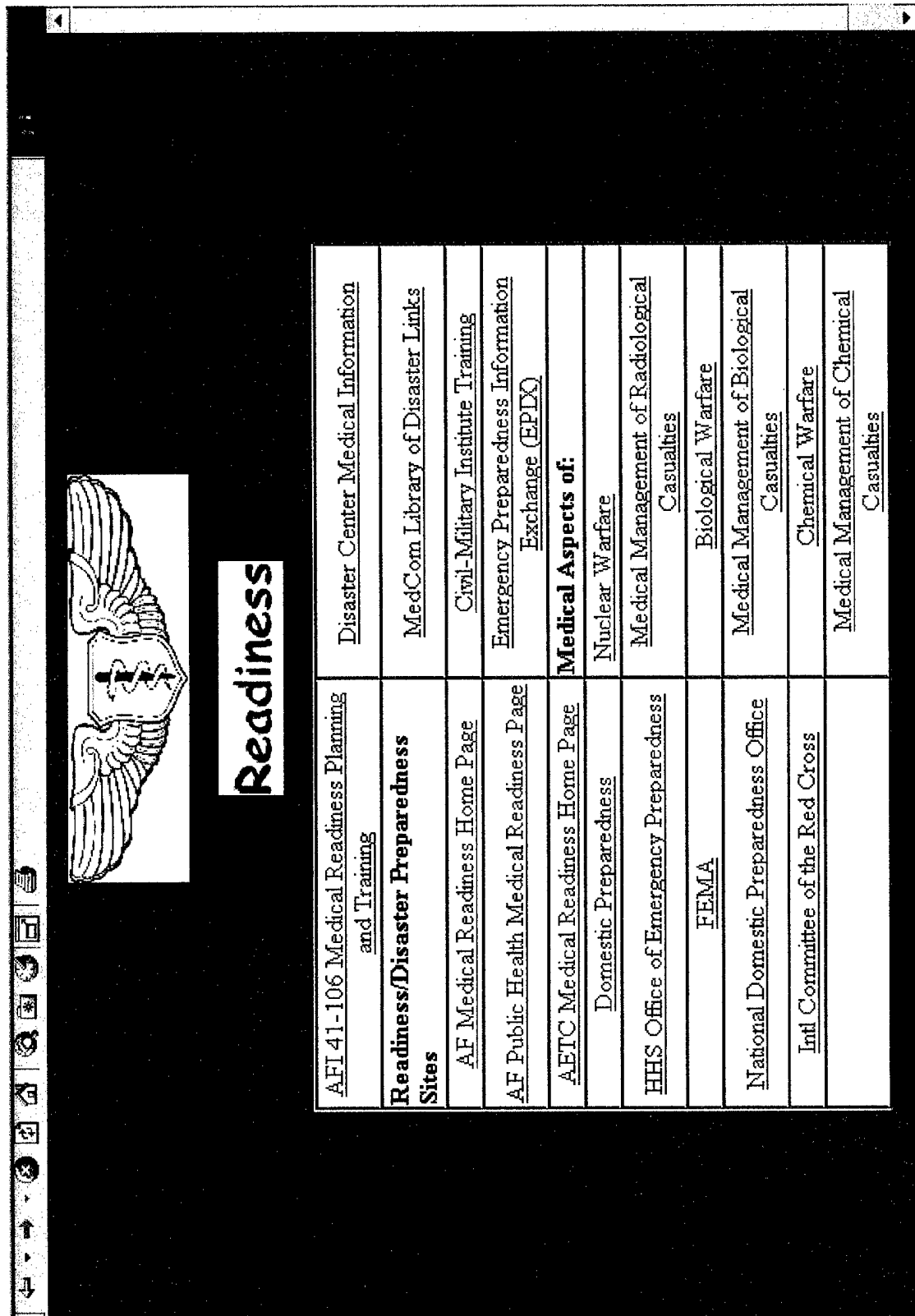


FIGURE 8: READINESS PAGE



<a href="#">AFI 41-106 Medical Readiness Planning and Training</a>	<a href="#">Disaster Center Medical Information</a>
<b>Readiness/Disaster Preparedness Sites</b>	<a href="#">MedCom Library of Disaster Links</a>
<a href="#">AF Medical Readiness Home Page</a>	<a href="#">Civil-Military Institute Training</a>
<a href="#">AF Public Health Medical Readiness Page</a>	<a href="#">Emergency Preparedness Information Exchange (EPDQ)</a>
<a href="#">AETC Medical Readiness Home Page</a>	<b>Medical Aspects of:</b>
<a href="#">Domestic Preparedness</a>	<a href="#">Nuclear Warfare</a>
<a href="#">HHS Office of Emergency Preparedness</a>	<a href="#">Medical Management of Radiological Casualties</a>
<a href="#">FEMA</a>	<a href="#">Biological Warfare</a>
<a href="#">National Domestic Preparedness Office</a>	<a href="#">Medical Management of Biological Casualties</a>
<a href="#">Intl Committee of the Red Cross</a>	<a href="#">Chemical Warfare</a>
	<a href="#">Medical Management of Chemical Casualties</a>

FIGURE 10: TRAINING PAGE

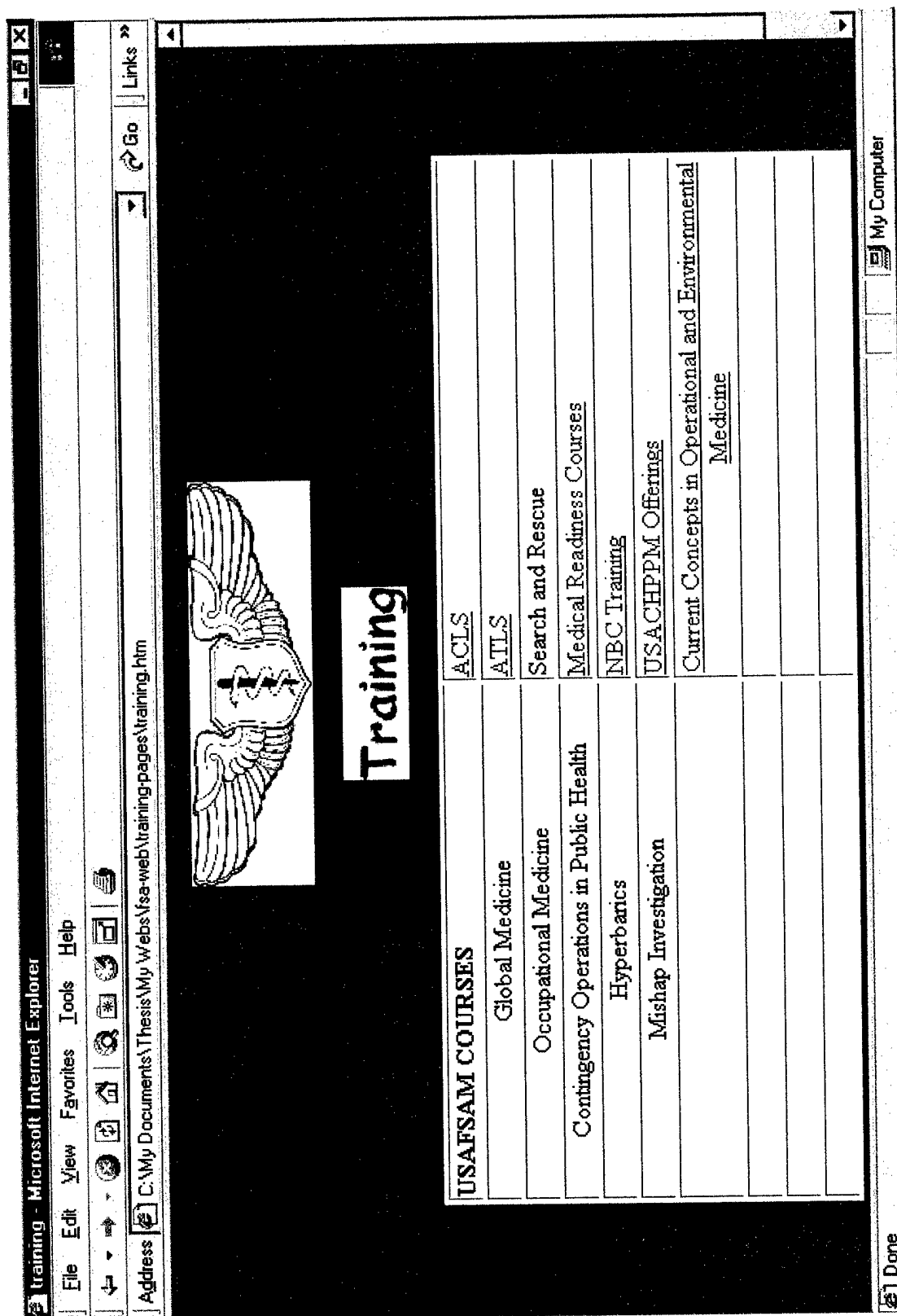
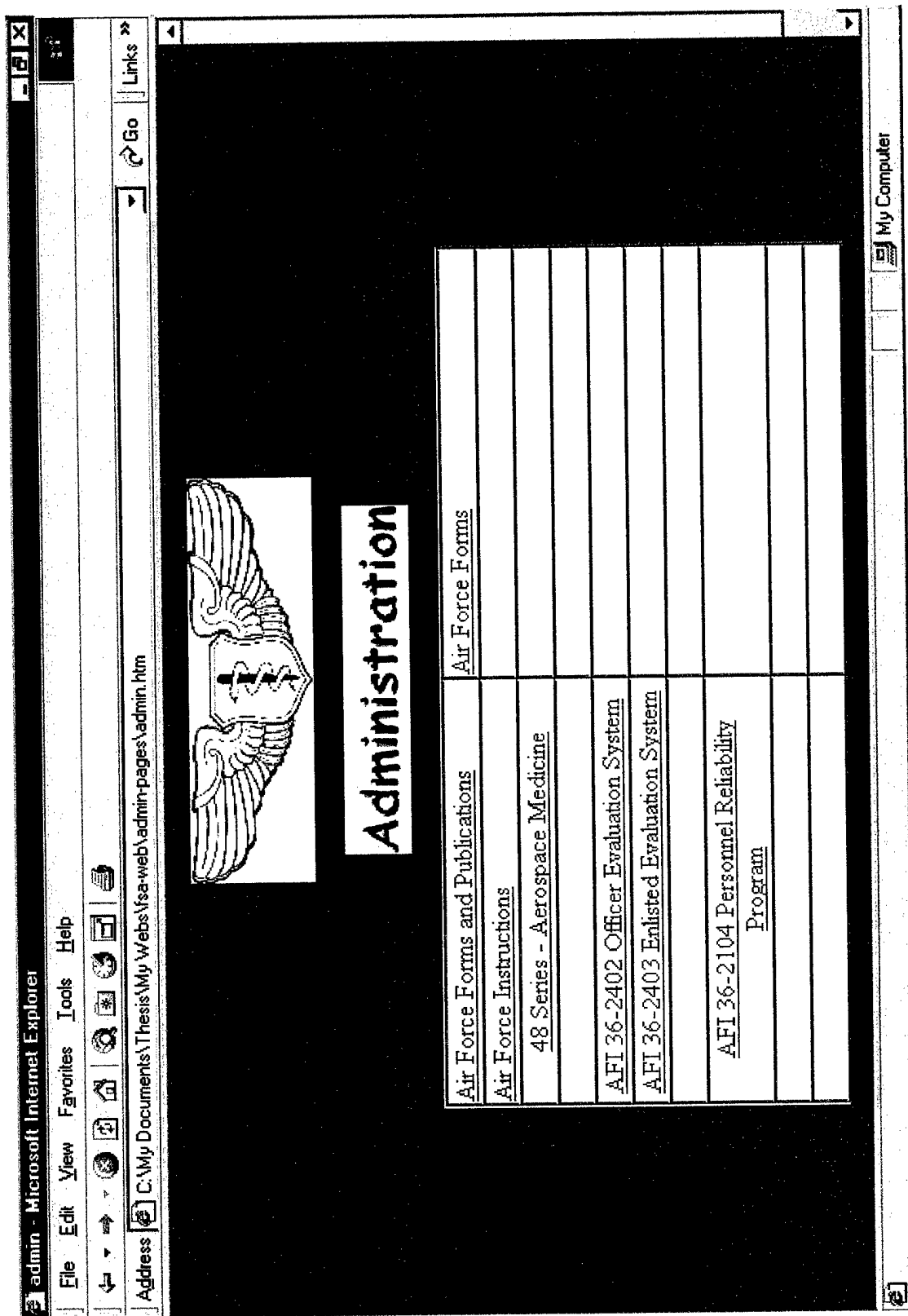


FIGURE 11: ADMINISTRATION PAGE



## APPENDIX D: LETTER OF INVITATION

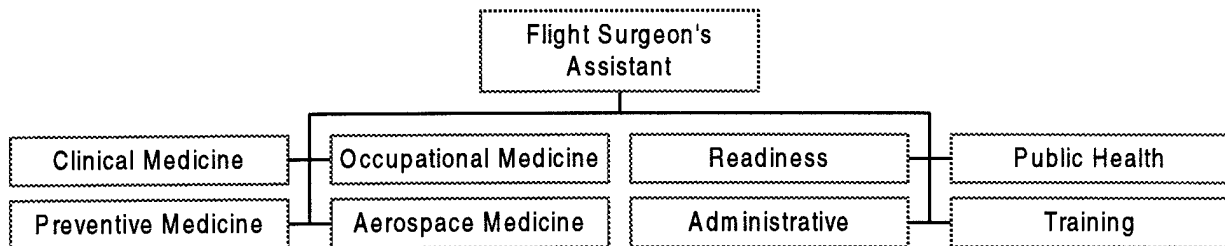
Invitation to Participate in a Research Study

CPHS HSC-SPH-00-034

Title: Requirements Analysis and Prototype of a Desktop Flight Surgeon's Assistant

Principal Investigator: Douglas M. Rouse, MD

I request your assistance in evaluating a computer tool I am developing as part of my master's thesis effort. I am constructing a prototype desktop software program to assist flight surgeons in obtaining information to help them in performing their day-to-day duties more efficiently. I envision an interface that would allow flight surgeons to rapidly access reference information on both clinical and administrative topics. A draft version of the top-level view of this interface is shown below:



Upon completion of the prototype, I will be asking you to assist me in evaluating the structure and utility of the system by attempting to find answers to a series of questions in a timed exercise. The exercise should take no more than 60 minutes of your time.

If you are interested in participating, please contact me either in person, by phone at (210) 363-5880, by email at [drrouse@pol.net](mailto:drrouse@pol.net), or just circle one of the choices below and return this paper to my mail box.

I sincerely appreciate your consideration of participating in this study. Hopefully, your input will allow me to develop a tool that may eventually allow flight surgeons to work more efficiently and effectively. There is no coercion to participate and no penalty or repercussion for not participating. You may withdraw your offer at any time.

**(YES) I WOULD LIKE TO PARTICIPATE**

**(NO) I WOULD NOT LIKE TO PARTICIPATE**

Please write your name below or if you wish not to have your name written on this document, contact me through one of the other methods listed above.

## APPENDIX E: INFORMED CONSENT DOCUMENT

**TITLE: Requirements Analysis and Prototype of a Desktop  
Flight Surgeon's Assistant CPHS HSC-SPH-00-034**

### **INVITATION TO PARTICIPATE IN A RESEARCH STUDY:**

- 1) You are being asked to participate in a research study entitled "Requirements Analysis and Prototype of a Desktop Flight Surgeon's Assistant".
- 2) Your decision is voluntary and you may refuse to participate, or withdraw from the study at any time.
- 3) a) Refusal or withdrawal from this study will have no effect on your position, grades, employment, promotion, or treatment by any faculty, staff, or students from the School of Public Health.  
b) You may refuse to answer any questions on questionnaires, surveys or during interviews without repercussion.
- 4) This study has been reviewed by the Committee for the Protection of Human Subjects of The University of Texas Health Science Center at Houston (CPHS) as HSC-SPH-00-034.

### **PURPOSE OF THE STUDY:**

- 1) The purpose of the study is to perform a requirements analysis and concept demonstration of a prototype desktop flight surgeon's assistant. The goal is for the participants to have an opportunity to use the prototype system to obtain an impression of the initial design. This exercise will give the participants a frame of reference to provide constructive feedback on their opinion of the potential utility of such a system and allow them to provide suggestions for improvement.
- 2) It is anticipated there will be approximately eight subjects enrolled. These subjects will be recruited with a letter of invitation from candidate flight surgeons enrolled in the UTHSCH MPH program in San Antonio. To qualify, a candidate subject must currently be a USAF flight surgeon with experience working in that capacity.

### **DESCRIPTION OF THE STUDY:**

Each participant will be asked to find reference material to answer a series of questions representative of problems which may arise in the day-to-day duties of a flight surgeon. For half of the exercise they will have a desktop computer with Internet access and several textbooks available to search for information to answer the questions. For the other half of



the exercise, they will use a desktop computer with the prototype flight surgeon's assistant to access the information to answer the questions. The amount of time needed to locate the information will be recorded with a maximum of 5 minutes allotted for each question. If a participant is unable to locate the necessary information in 5 minutes, they will go on to the next question and leave the current question unanswered. Upon completion of the exercise, participants will be asked to provide feedback on the potential utility of such a system and suggestions for improvement.

TIME COMMITMENT:

Participants will be asked to provide approximately 80 minutes of their time for completion of the exercise.

ORDERLY WITHDRAWAL FROM THE STUDY:

The subject may stop participation in the study at any time with no adverse effect. The individual may notify the principal investigator in person, by email, or in writing if he/she wishes to withdraw from the study.

TERMINATION OF PARTICIPATION:

The principal investigator may terminate a subject's participation in the study if insurmountable technical problems with the hardware or software occur.

BENEFITS:

There will be no direct benefit to you for taking part in this research project.

RISKS:

Minimal. No personal information will be obtained and confidentiality will be maintained. Mild psychological stress and frustration may occur in attempting to find reference information in a timed exercise using a desktop computer. This type of stress is anticipated to be similar to, but significantly less than that experienced when taking any academic examination of similar duration. In this case though, no grade will be given and no adverse effect or repercussion will occur regardless of performance. Individual participant responses to the questions in the exercise will not have any personal identifiers associated with them.

COMPENSATION FOR INJURY:

If you suffer any injury as a result of participation in this research study, please understand that no provision has been made to provide free treatment of the injury, or any other financial compensation. However, necessary facilities, emergency treatment and professional services will be available to research subjects, just as they are to the community generally. You should report any such injury to Douglas M. Rouse, MD at (210) 363-5880 and to the CPHS at (713) 500-5827.

FINANCIAL CONSIDERATIONS:

Participation in this study is completely voluntary and subjects will receive no compensation of any type.

CONFIDENTIALITY/ANONYMITY:

No personal information will be recorded on any individual participating in this study. Every effort will be made to ensure confidentiality of information provided by participants and anonymity of participation. Individual and aggregate results will be included in the final thesis report and may be included in subsequent publications.

FOR FURTHER INFORMATION ABOUT THIS RESEARCH STUDY:

The principal investigator, Douglas M. Rouse MD, will be glad to answer any further questions at any time, at (210) 363-5880 or email to drrouse@pol.net.

BEFORE INFORMED CONSENT IS SIGNED:

By signing below, you are agreeing to participate in this research study. Make sure that any questions have been answered to your satisfaction and that you have a thorough understanding of the study. If you have any questions as to your rights as a research subject, call the CPHS at (713) 500-5827. If you decide to participate in this research study, a copy of this document will be given to you.

\_\_\_\_\_  
Subject's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Person Obtaining Consent

\_\_\_\_\_  
Date

## APPENDIX F: PRE-BRIEFING CHECKLIST

1. Informed Consent reviewed and signed.
2. Describe basic purpose of Flight Surgeon's Assistant (FSA) and evaluation.
3. Inform participant of timed review periods: a) 2 minutes to review reference books, b) 1 minute to review browser and "Favorites", c) 2 minutes to review FSA
4. Commonly used reference material is included in a folder labeled "Flight Surgeon's Assistant" in the "Favorites" folder on your browser.
5. Inform participant that when they find an answer to call "time" and show the specific answer to the question. Do not call time when you have found the page you think the answer is on, only when you find the specific answer.
6. Inform participant that they must locate an answer somewhere. They cannot answer a question from their own knowledge/memory.
7. Inform participant they will have 15 seconds to read each question and 5 minutes to find an answer.
8. When using the FSA, think topically. Every answer may be associated with aerospace medicine in some way, but not every question has an answer under the aerospace medicine icon.
9. Start at the "home" page at the beginning of each letter category of question. Some answers in the same letter category may be found in the same document, thus when answering questions within a letter category, leave the page up from the previous question.
10. Use any search engine you wish to hunt for answers on the Internet.
11. You may use "Ctrl F" to search for keywords and phrases in large documents. In Adobe PDF documents, you may use the binoculars icon to perform the same search and the binoculars icon with the hooked arrow to find subsequent instances.
12. Adobe page counters may not correspond with the actual page number in a document. Be sure to check the actual page number against the Adobe page counter.

# APPENDIX G: RESPONSE TIME DATA

Question	Subject Response Times (fractional minutes)							
	1	2	3	4	5	6	7	8
1 (-FSA)	4.67			3.72	5.00			5.00
1 (+FSA)		4.68	4.52			2.77	3.17	
2 (-FSA)	5.00			5.00	4.72			1.07
2 (+FSA)		1.87	5.00			5.00	4.10	
3 (-FSA)	5.00			5.00	5.00			5.00
3 (+FSA)		0.43	1.42			2.00	1.10	
4 (-FSA)	5.00			*	2.20			5.00
4 (+FSA)		0.57	0.53			0.33	1.53	
5 (-FSA)	0.82			4.25	5.00			3.70
5 (+FSA)		0.50	*			1.18	1.52	
6 (-FSA)	0.17			0.02	1.05			0.05
6 (+FSA)		0.17	0.92			0.43	0.48	
7 (-FSA)	4.73			3.33	2.30			5.00
7 (+FSA)		3.08	5.00			2.87	4.37	
8 (-FSA)	3.72			5.00	5.00			5.00
8 (+FSA)		4.52	2.08			3.30	4.35	
9 (-FSA)	1.97			2.28	5.00			5.00
9 (+FSA)		3.13	4.77			3.42	2.57	
10 (-FSA)	5.00			1.65	0.72			2.03
10 (+FSA)		0.37	1.65			0.37	5.00	
11 (-FSA)	5.00			1.70	0.63			1.65
11 (+FSA)		4.87	1.95			1.83	1.47	
12 (-FSA)	2.92			1.32	3.17			5.00
12 (+FSA)		1.53	1.78			5.00	4.98	
13 (-FSA)	0.68			1.52	2.73			3.37
13 (+FSA)		1.50	2.43			1.52	0.98	
14 (-FSA)	5.00			5.00	5.00			5.00
14 (+FSA)		0.80	2.12			2.12	1.10	
15 (-FSA)	5.00			5.00	3.43			3.93
15 (+FSA)		0.90	1.95			2.33	0.25	
16 (-FSA)	3.02			4.90	1.18			2.80
16 (+FSA)		0.98	2.13			1.26	1.68	

\* Data withdrawn due to experimental discrepancy.

Note: Data converted from seconds to fractional minutes, thus valid only to the nearest tenth of a second.

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## VITA

Major Douglas M. Rouse was born in Warsaw, New York, on 14 November, 1962, the son of Marjorie Goodrich and Michael Rouse. After completing his studies at Keshequa Central School, Nunda, New York, in 1980, he entered Clarkson University in Potsdam, New York. He received the degree of Bachelor of Science in Chemical Engineering in May, 1984, and the degree of Bachelor of Science in Electrical Engineering in May, 1985. He subsequently entered the School of Engineering, Air Force Institute of Technology, Wright-Patterson AFB, Ohio, where he received the degree of Master of Science in Electrical Engineering in December, 1986. He was then assigned to the Flight Dynamics Laboratory at Wright-Patterson AFB where he worked first as Project Engineer on the In-Flight Simulation Program until June, 1987, and then as Project Engineer on the Pilot's Associate Program until August, 1991. He subsequently entered the Uniformed Services University of the Health Sciences where he received the degree of Doctor of Medicine in May 1995. He completed an Internship in Psychiatry at Wilford Hall USAF Medical Center, Lackland AFB, Texas, in June, 1996 and continued in the Psychiatry Residency until April, 1997, when he left to work as a Flight Surgeon at Lackland AFB. He was selected for the USAF Residency in Aerospace Medicine and began the Master of Public Health program in July, 1999, at The University of Texas-Houston Health Science Center School of Public Health San Antonio Satellite Program. He is married to Elizabeth B. Aldrich and they have two daughters, Cameron and Chandler.

Permanent address:           1602 Oakcask  
                                  San Antonio, TX 78253

This thesis was typed by Douglas M. Rouse.